SCIENCE AND INDUSTRY
MAY 25 1944
LOS ANGELES PUBLIC LIBRARY

ORGANIC GARDENING

Table of Conte

LOS ANGELES PUBLIC LIBRARY
630 S HOPE ST
LOS ANGELES CALIF
STACKS

WITH THE EDITOR — THE CLEAN CULT

THE EARTHWORM .....

MULCH ADO .....

HOW TO ECONOMIZE ON FERTILIZER 8

HINTS FOR THE VICTORY GARDENER 12

THE COMPOST GARDENER 14

THE SUBSOILER 15

HEALTH AND FOOD 17

SHORT CUTS IN COMPOST MAKING 18

MAGIC RESULTS FROM MULCHING 22

DIGGING THE GARDEN AND SOIL FERTILITY 24

TOMATO COMPOST 26

READER'S CORRESPONDENCE 27

REFERENCE
DO NOT LOAN

HELP THE WAR EFFORT
USE ONLY HOME-MADE ORGANIC FERTILIZERS

MAY, 1944

A RODALE PRESS Magazine

25c

ORGANIC GARDENING BOOKS

COMPOST — How To Make It

A pamphlet of 64 pages answering many questions about the best way to make compost. This book consists of material that has appeared in Organic Gardening from time to time. **.25**

Gardener's Companion Cards

At the last moment when you are ready to put in those radishes, are you in doubt about some important information as to how to apply humus, depth of planting, width, ets? Do you rush into the house and spend precious quarter-hours poring through encyclopedias or other books? Here is your answer.

A set of 40 cards, each one representing a different vegetable, printed with uniform paragraph groupings so that you know where to look on each card for any kind of vital information you need in a hurry.

Take the card right with you into the garden. Will fit in your pocket. Handsomely boxed. Makes a splendid gift.

For Medium Northern Climate. **$1.00**

3 Debates in House of Lords

A pamphlet of 55 pages which gives in complete form the two thrilling debates held in England on the advisability of forming a Royal Commission to check on the Sir Albert Howard method of farming and gardening. It is chockfull of amazing information and reads like a novel. . . . . **.25**

Sleep And Rheumatism

A CLOTHBOUND BOOK

Written By J. I. Rodale,

Editor of ORGANIC GARDENING

Mr. Rodale, always interested in natural methods of obtaining health, has made a startling discovery regarding pressures we exert on parts of our body during sleep, which cause stubborn conditions of neuritis in the fingers, arms, shoulders and neck.

Miraculous cures have been obtained by persons who have followed the simple rules explained in this book. **$1.50**

Vegetable Mould And Earthworms

BY CHARLES DARWIN

This is a pamphlet which represents a condensed version of Darwin's famous classic on the earthworm. It contains the most important parts of his revolutionary work and is a MUST for every organic gardener and farmer. **.25**

Bio-Dynamic Farming And Gardening

BY DR. EHRENFRIED PFEIFFER

A 240 page clothbound book describing in full the Bio-Dynamic methods, by an acknowledged authority. Some of the chapters are:

The farmer of yesterday and today
The soil, a living organism
The load limit in agriculture
The treatment of manure and compost
How to convert an ordinary into a bio-dynamic farm
Comments on market gardening
The dynamic activity of plant life
Fertilizing: Its effects on health
Scientific tests
Practical results of the bio-dynamic method.

$2.00

Grow A Garden

AND BE SELF-SUFFICIENT

By Dr. Ehrenfried Pfeiffer and Erika Riese

A cardboard covered book of 118 pages with many beautiful illustrations and garden plans. Written from a practical background of many years of actual experience in applying the bio-dynamic method to vegetable gardening.

Gives detailed instructions for growing each vegetable from the bio-dynamic point of view and is a gold-mine of information of untold value to the home gardener.

Contains a complete description of the placing of vegetables in the garden from the point of view of compatibility and effects one upon another. **$1.25**

THESE PRICES ARE POSTPAID — FOREIGN ADD 25c PER VOLUME.

ORGANIC GARDENING — Emmaus, Pennsylvania

ORGANIC GARDENING

EMMAUS, PA.

Vol. 4, No. 6. May, 1944 | $3.00 a year | 25c a copy

J. I. Rodale, Editor | Sir Albert Howard, C.I.E., M.A., Associate Editor

With The Editor

THE CLEAN CULTURISTS

Ground-Up Rocks as a Fertilizer

MANY persons believe that farming can be carried on without the use of animal manures. They call themselves *clean culturists* and their system is known as *clean* culture. This theory was first offered by Julius Hensel at Christiana, Norway, in 1885. He was against the use of manure and commercial fertilizers, advocating only finely ground up rocks that he called *stone meal.* Some of the scientific professors sided with Hensel, others sneered, and a heated controversy flared up in the press. A few factories were erected to manufacture this stone meal and in 1892 an exhibition was held in Leipzig, Germany, at which were shown crops grown with this dust.

In 1924 Jack Gaerity, an American farmer, resurrected the work of Hensel and wrote a booklet based on it, called "Bread and Roses from Stones." In it he says, "Stone dust has been successfully used in England, but it faces the concrete wall of academic opposition there too. For several years, I am informed, a stone dust fertilizer has been on sale, under the trade name of "Fluora." The British Board of Agriculture, dominated by academic scientists, will not permit it to be sold as a fertilizer. It is distributed as a 'soil dressing'." He states further, "J. A. Minchin, Esq., of Henfield, Sussex, states: "I have, even this dry Summer (1919), grown most splendid salads with the aid of *Fluora.* My winter green stuff, Brussels sprouts, etc., are also looking remarkably well and strong."

Again he says, "B. Wettengel, a German farmer, writing in the 'Wiesbadener General Anzeiger' of July 1, 1893, says, 'I have been using stone dust fertilizer in my garden and fields for five years. The results have always been satisfactory in every respect, for the soil becomes better every year by using this fertilizer. Especially this year during the extraordinary drought, the excellent effects of stone dust fully manifested themselves. The flowers as well as the different vegetables developed so magnificently that every person who passed my garden stopped and admired the great growth, especially of the Kohlrabi'." Gaerity says further, "hundreds of British and German users might be quoted in praise of it. One quotation from each source, however, must suffice."

Dr. Wm. Crocker, an agronomist writing in "The Manufac-

Read Magazine, Inc. Executive and Editorial offices, 6th and Minor Sts., Emmaus, Penna. Subscription rates 12 issues for $3.00. **ORGANIC GARDENING,** published 12 times a year by Read Magazine, Inc., 6th and Minor Sts., Emmaus, Penna. Entered as second class mail at the postoffice at Emmaus, Penna., under the act of March 3, 1879. Printed in U. S. A.

turer's Record" of November 27, 1919 stated that, "a balanced ration of natural rock fertilizers is possible." Professor Wm. A. Albrecht of the University of Missouri in an article in the Land recently very aptly said. "What is soil, after all? It is a temporary rest-stop while the rock is on its way to the sea." It is an elementary fact that soils have been formed from rock, but why wait for the slow, mouldering process of rock disintegration? There are for example many phosphate rock deposits in this country which are being sold daily in a ground-up form as fine as flour. But this is not satisfactory to the University agriculturists. It is still too slow acting. It is too mild. What they want is something that will give the earth a shot-in-the-arm and produce results next week, regardless of the evil, residual consequences. So to the ground-up phosphate rock they add the highly corrosive sulphuric acid and produce the much-used superphosphate. Raw phosphate rock ground up fine may be safely used but not its cousin, superphosphate. Phosphate rock may be slow-acting but next year does have a habit of rolling around.

In the United States there is an enormous amount of rock. A survey might be made to ascertain special qualities in it and tests made of the effect on the land. Some stone may have caustic properties and would have to be eliminated. Only those that are mild in action and that would not kill earthworms should be used. Charles Darwin in his famous book on the earthworm described how they swallow tiny rock particles which they grind up in their gizzards. With the use of powerful digestive juices they disintegrate tiny bits of rocks. They sift the finer from the coarser particles, thus producing soil fit for the finest gardening. The earthworm, therefore, would be an invaluable ally where much pulverized rock would be applied to the soil. However, they could not live exclusively on it and would have to get organic material, too.

In time to come more attention will be paid to the study of rocks and their possible use in agriculture. They come in almost every color of the rainbow, and the colors are important clues to their constituents. For example limestone, which is a soft rock, comes in white, yellow, cream, blue, gray, black, red, green and varied colors like marble. Yellow or cream is an indication that it contains iron oxide, green that it contains chlorite, etc. Some rock like quartz is a very hard mineral. Limestone, on the other hand, when pure may be readily scratched with a coin. Quartz, by the way, is used as a spray material, in the bio-dynamic method.

The fact that the inclusion of ground rock in our soils may be extremely important from a nutritional standpoint is corroborated by a statement made by the great financial authority Roger W. Babson. In his daily newspaper column he recently said, "Why do the best trotting horses come from Kentucky? The answer is in the soil and this applies only to certain small sections. Why have the best brains grown in certain valleys of New England, New York State, Pennsylvania and Virginia? The answer is that the soils of these valleys—washed down during the centuries from rocky hills—contain the needed minerals to make the best brains. I have especially in mind potassium, phosphorous, iron, iodine, calcium and magnesium. If you doubt me, ask the publishers of 'Who's Who' to give you their opinion on this subject."

In connection with ground rock, the story of the Hunzas of India is not only to the point, but startlingly so. The *Wheel of Health* by Dr. G. T. Wrench of London is the saga of the Hunzas whom he called about the healthiest people in the world. These Hunzas have tremendous endurance and are extremely good-tempered and cheerful. They think nothing of covering 60 miles at one stretch, climbing over mountains on the way, doing their business and then returning. The Royal Geographical Society in 1928 said, "The Hunza men were with us two months, continuously on the move, over what is probably some of the worst country in the world for laden men. Always ready to turn their hand to anything, they were the most cheerful and willing set of men with whom we have ever traveled."

Mildred Jensen Loomis in an article in Organic Gardening (May 1943) called *The Wheel of Health* says, "They (the Hunzas) use everything they can return to the soil—cattle manure, vegetable parts and pieces not used for stock food, fallen leaves, human sewage from privies after six months, silt from recesses in their irrigating channels, wood ashes from fires; all these are mixed together and made into a compost. This, along with alkaline earth from the hills, they spread carefully on their vegetable fields. In Hunza (as in China, Japan and ancient Peru) agriculture is a gardening, a care of the soil, a repayment of the soil, carried on by men and women with never-ending industry. Prof. N. I. Vavilov, famed botanist who has studied ancient agriculture says, 'It may perhaps be that it was in the country of Hunza that in the distant past

this form of compost-culture first came into being in Asia'."

Anent the use by the Hunzas of ground-up rock, Sir Albert Howard in his "Agricultural Testament" says, "There is one point about the Hunza agriculture which needs further investigation. The staircase cultivation of these hillmen receives annual dressings of fresh rock-powder, produced by the grinding effect of the glacier ice on the rocks and carried to the fields in the irrigation water. Is there any benefit conferred on the soil and on the plant by these annual additions of finely divided materials? We do not know the composition of this silt. If it contains finely divided limestone its value is obvious. If it is made up for the most part of crushed silicates, its possible significance awaits investigation. Do the mineral residues in the soil need renewal as humus does? If so, then Nature has provided us with an Experiment Station ready-made and with results that cannot be neglected. Perhaps in the years to come, some heaven sent investigator of the Charles Darwin type will go thoroughly into this Hunza question on the spot, and will set out clearly all the factors on which their agriculture and their marvellous health depend."

It should be noted that the Hunzas put everything back in the soil—animal matter, plant matter, excrement, rock powder, etc. Not so the disciples of Julius Hensel and no doubt that is why much is not heard of his system today. Results were probably obtained for five or six years or more while the accumulated fertility of prior years was being dissipated. Then trouble ensued.

Jack Gaerity says that the mineral plant foods in the soil were originally locked up in solid rocks. "They are present in virgin soils to a large extent because such soils are made up of decayed rocks and humus." Note that he includes humus, for without that you cannot have a full-bodied, live soil.

Lyon and Buckman in "The Nature and Properties of Soils" (Macmillan) state, "a true soil cannot be formed without the presence and decay of some organic matter. Mere physical and chemical weathering of rocks should not be confused with soil formation. As a result most soil processes are directly or indirectly biological in nature." This means that bacteria, fungi, other micro-organisms and earthworms, etc. must play their part in producing a live, fertile soil, that organic, animal and vegetable matter must be added from time to time to maintain the physical structure of the soil, to furnish the trace elements, animal hormones and plant growth substances which recent research has demonstrated must be present to carry on successfully in agriculture.

I have come in contact with a few persons who are following Julius Hensel's teachings. They usually refer to animal manures as filthy stuff. However, they do use vegetable composts. Some of them use such composts exclusively as they are unable to get the stone-meal. But they will not use animal manure in any form. None of these persons has carried on long enough in one location to really test out the idea.

Captain J. M. Moubray who operates thousands of acres in Southern Rhodesia sent a letter to the "Rhodesia Herald" on June 4, 1943 in which he said, "Mr. Martyn in last Friday's issue has missed some of the essential differences between green manuring and compost. In properly made compost, by which I mean a material derived from both animal and vegetable wastes, there occur certain trace elements and plant growth substances. Without very small supplies of these, plant growth eventually ceases.

"Dr. Hugh Nicol writes me that such things as indoleacetic acid, auxine, the hormones and other substances are a product of decomposition in the gut of the animal. Some of these are essential for plant growth and when used up in a soil must be replaced. I can imagine under certain conditions a green crop giving as good a following crop when ploughed under as when composted and then added to the land; but such a state of affairs can only continue for a limited period.

"One of the best examples of these plant growth substances becoming exhausted is to be seen in some old citrus groves throughout the country where growth has stopped. By liberal applications of farmyard manure or compost it is possible to "bring back" such trees."

* * *

"Sir Albert Howard tells me that in India without an application of animal wastes, which may be quite small, legumes do not produce seed in a satisfactory manner. I have proved this with san hemp—land that followed maize gave a poor return, but similar land to which a small amount of compost had been added gave more than double the quantity of seed."

Sir Albert in *The Testament* further stated, "In Ceylon particularly, attempts have been made to prepare humus without animal wastes. The results have not fulfilled expectation. The breaking down of such resistant material as the leaves and prunings of tea is then unsatisfactory; the organisms which synthesize

humus are not properly fed: the residues of these organisms which form an important part of the final humus lack the contributions of the animal. No one has yet succeeded in establishing an efficient and permanent system of agriculture without live stock. There is no reason therefore to suppose that the tea industry will prove an exception to what, after all, is a rule in Nature."

Under the bio-dynamic method there are two kinds of compost heaps, one made from vegetable matter exclusively (including earth and certain extracts,) and one made only from manure (also with earth and extracts). Regarding this Dr. Ehrenfried Pfeiffer in *Bio-Dynamic Farming and Gardening* says, "Compost is a mixture of earth along with every sort of organic refuse, which rots without having gone through an animal organism. It therefore lacks the presence of animal hormones, which even when present in infinitesimal amounts, foster plant growth."

The quality of the animal matter also assumes a very peculiar importance. Where manure comes from animals that are fed with organically-produced food it is far superior and produces a more potent compost than that which comes from animals fed indifferently. And this quality increases from year to year as a farm gets richer and richer in organic capital. In this respect Dr. F. M. Pottenger, Jr. of Monrovia, California, who has done interesting work with cats went a step further. His experiments, described in the *Transactions of the American Therapeutic Society*, Volume XLI, 1941, tend to show that manure from healthy cats produce better crops than that from sick ones. He found that the odor of the manure of the sick cats was much more putrefactive than that from the healthy ones. If animal manure is not available, especially in small gardens, substitutes such as dried blood, tankage. etc. will be found to be effective. There should be some animal matter, however small in amount. The small gardener has access to kitchen wastes which include bits of meat and other matter of animal origin.

Chemical Activators for the Compost Heap

Practically every Government agricultural experiment station has issued a bulletin describing the production of artificial manure, or compost. But unfortunately they recommend chemical activators, in the form of the worst chemical offenders such as ammonium sulphate (which is instant death to earthworms), cyanamid, nitrate of soda, urea, mixed with lime, etc. The big wheat combines leave the straw on the land and many farmers have been sadly disappointed when this was plowed under as it actually had a negative result on the new crop. To allow straw to rot in piles would take years so these Government stations advocate the chemical method following along the general lines of *ADCO*, a chemical product which is a substitute for animal matter in the compost heap.

Rotting is accomplished by micro-organisms which need a goodly quantity of nitrogen for the process. Since straw is somewhat lacking in this element these nitrogenous chemicals are used. In a bulletin issued by the University of Missouri, No. 369, appears the statement that the use of such chemicals "duplicates the manner in which animal urine acts on the bedding to produce farm manure." The use of animal manure impregnated with the urine of the animals producing it is far superior to any chemical formula devised by man. All of the arguments against the use of chemicals direct on the land apply equally well to their use in the compost heap. Stress is laid, in their use, on the mere obtainance of big crop yields without considering quality, disease resistance, etc. But any novice can tell at a glance by comparing the two finished composts which is of better quality, the one having the odor of fragrant woodsy earth, the other a noxious smell and coarser in appearance.

Dr. M. C. Rayner, who has done such brilliant work in England with the Mycorrhiza fungus, quickly found that organically produced composts were most effective in forestry nursery work. She made composts both with dried blood and an ammonium salt. The results in connection with the latter were quite poor. Yet when she called in an expert to make a chemical analysis he pronounced the organic compost of dubious value and the chemical one as a "first-class organic manure." Actual results just didn't bear out his verdict.

No acceptable substitute for animal matter has as yet been devised, nor is there anything as simple to handle and without the fear of disastrous consequences due to burning, overdoses, etc. I feel quite certain that the fertilizer formula of the future will consist of plant matter, animal matter and finely ground up rocks. In fact this is the answer to those who say we must use chemical fertilizers because there is insufficient plant and animal matter available. There is an inexhaustible store of rock. Think of such tremendous aggregation of rocks as the Rocky Mountains. This is a simple formula and will require a minimum of chemical knowledge.

J. I. RODALE.

THE EARTHWORM:

THE GARDENER'S UNPAID HANDY MAN

BY SIR ALBERT HOWARD, C. I. E.

IN the deluge of advice nowadays showered upon the gardener and allotment holder by the radio, by the Ministries of this and that, and in a torrent of books and pamphlets, there is one serious omission. Little or nothing is said about the unpaid labour force in the soil itself, without whose co-operation the grow-more-food campaign cannot possibly succeed. This labour force is largely invisible; it consists of animals and plants, many of which can only be seen under the microscope, but an exception among the animal population is the earthworm. Among the microscopic plants in the soil moulds and microbes are the most important. Unless this mixed population is kept in good fettle the produce of a garden is never fit to eat. But once the gardener looks after his unpaid workers, everything else will follow: a satisfactory crop of good taste and quality and of high nutritive value will be a foregone conclusion: artificial manures will be unnecessary: the plants will protect themselves from insect, fungous and virus diseases: there will be no need for the fungicides, insecticides and germicides now used as antidotes for soils poisoned by chemicals.

In the murder of our soils, now proceeding so merrily, perhaps the chief victim is the lowly earthworm, whose beneficient activities—so graphically described in 1882 by Charles Darwin in *The Formation of Vegetable Mould through the Action of Worms with Observations on Their Habits*—are now, alas, almost forgotten.

How can earthworms assist the gardener? In the first place they keep the soil fit for its population by providing a ventilating system in the shape of their tunnels. By this means the life of the soil obtains its supply of oxygen from the atmosphere and also expels its used-up air. Moreover, these tunnels allow the surplus rainfall to drain away into the sub-soil. In the second place the earthworms condition the food materials needed by the roots of plants. This is accomplished by means of their casts which in a garden soil in good condition may exceed 25 tons to the acre in a single year. The casts are manufactured in the alimentary canal of the earthworm from dead vegetable matter and particles of soil. In this passage the food of these creatures is neutralized by constant additions of carbonate of lime from the three pairs of calciferous glands near the gizzard, where it is finely ground prior to digestion. The casts which are left contain everything the crop needs—nitrates, phosphates and potash in abundance and also in just the condition in which the plant can make use of them. Recent investigations in the United States show that the fresh casts of earthworms are five times richer in available nitrogen, seven times richer in available phosphates and eleven times richer in available potash than the upper six inches of soil. The earthworm is, therefore, the gardener's manure factory.

The reaction of the roots of a crop like the potato to a fresh worm cast is illuminating. A few years ago in South Lincolnshire, while investigating the root development of this crop, I observed that the fine roots of the potato plant in passing downwards into the subsoil always made full use of the tunnels of the earthworm. In these galleries fresh worm casts are constantly being deposited. Whenever a fine root passed one of these deposits, it at once formed a web-like network of new roots which closely invested the cast and penetrated it in all directions. Then the root continued its downward passage into the subsoil. Obviously the potato was removing something from the casts, otherwise this network of new roots would not have been developed. The recent work in the United States explains what it was the roots were seeking.

Feeding the crop is not the

last service performed by earthworms. They are the ideal soil analysts and furnish the gardener with a report on the state of his land far more instructive than anything the soil scientist has so far provided. All that is necessary is for the gardener himself to make a rough count of the earthworms in the top spit of soil and to observe their colour, general condition and above all their liveliness. If, in each spadeful during the autumn digging, one glistening, red, active lob-worm occurs, about the thickness of a man's little finger, then all is well with the soil and the quality of next season's crop is assured. There will be no need for plant nutrients of any kind: no anxiety need be felt about pests. But if the worms are few, coiled up in balls, or pale in colour and sluggish in their movements, then the next crop will be poor and trouble with pests will be inevitable. In this country our old and experienced gardeners pay great attention to the earthworms and often base their manuring largely on the indications they furnish. In the cases of the Sahara the tribesmen also make great use of the earthworm as a soil analyst. They judge the value of land by the number of worm casts appearing on the surface.

In return for what the earthworms do for the gardener all that is needed is to supply these animals with the right kind of food and to avoid the use of unnatural nourishment. Earthworms thrive on farm-yard manure, or better still on freshly made compost manufactured from vegetable and animal wastes. On a diet of artificial manures and poison sprays they either perish outright or abandon the garden to its fate.

In the planning of the future we must all see to it that the extermination of the earthworm ceases and that these creatures get a square deal. If we fail in this duty to the soil from which we all spring, Mother Earth will hit back and after a series of warnings will finally wipe us out of existence. We must at all costs avoid being weighed in Nature's balance and found wanting.

MULCH ADO

BY SUE RICE HENYON

Reprinted from Junior League Magazine (April, 1944)

WE are the kind of gardeners whose revolutionary ideas cause the neighboring farmers to laugh immoderately and we must be the subject of some pithy conversation around the cracker barrel. But they kindly, though pityingly, make contributions of golden bantam corn and cucumbers and advise us in all our works.

Two lone women, with temerity to buy a small farm 11 miles from town and remodel the house, establish a household garden in a field of quack grass, and recondition some 30 expiring apple trees, seem doomed to failure as the day is doomed to sunset. However, with literally no labor during the summer and the plowing of our third of an acre the only help we get from mankind, we still have fed our fluctuating family all the vegetables needed, and have canned for winter use. Until last summer our work was done mostly on week ends, as both of us were employed, but last summer one of us gave up her position and dug in for a full summer of life on the farm.

We were first attracted to Bio-Dynamic Farming and Gardening as a feasible way to give back to the soil the nourishment we had taken out in crops. We joined the association of that name but were soon up against the fact of our lack of strength to lay up the compost heaps and turn them. Our small plot would take tons of material, and to make it requires more tons of all sorts of green stuff laid in carefully constructed layers and kept at an exact degree of moisture for a period of three months. We literally have not the muscles to lay up these piles, carry water to them, put it on in spray form and later turn the piles at least once.

Our next short cut was in Organic Gardening, a modified form of the same idea of making compost to enrich the garden. This

went much better, and we succeeded in making one heap of fine black soil filled with all the organic elements, which we used when planting, to fill the drills. This fed the seeds as they sprouted and kept the soil from caking as well as holding the moisture far better than plain soil does. In addition to using the compost, we mulched between the rows over the entire garden and did it indefatigably all summer, using grass clippings, grass mowed from the uncultivated fields, weeds not yet at the seeding stage, and ancient hay from the barn.

We learned to lay it between the crops, not too thick, so it would not heat up too much before drying, and to add layer on layer until it was two or three inches deep. This held the moisture near the surface of the soil and kept the weeds down to a minimum, also kept the alleys between the rows from packing when walked on. It was perfectly satisfactory for our purposes and we plan to continue this method and put it into further practice this summer.

Since we cannot spray our apple trees, we shall try to make them blight-resistant by treating them with a thick cover of hay on the roots, from a couple of feet out from the trunks to the extent of the branch spread. This cover will be six inches deep at the end of the summer and will be left on the ground to rot down and each year more will be added. A similar hay, straw, or tall grass mulch was put around the berry bushes last year and helped the weeding problem beyond words; this year the rotted mulch will feed the bushes. After cutting the asparagus we shall add the same mulch to that bed.

Since the publication of the super-reactionary *Plowman's Folly*, our most urgent desire is to buy, beg, borrow, or steal a disk harrow, for Mr. Faulkner expounds the virtue of the organic farming we have long advocated, but his method of practicing it is simpler, more logical, and takes less labor than any of the methods we have tried. If we can get a disk, we shall put all our energies into rigging it up to our decrepit truck and learn to "chew" the organic matter into the surface of the garden instead of plowing. When we have begun this "stubble mulching" or "trash gardening" as it is sometimes called, we can use our hard-won compost to start seedlings and to enrich the flower gardens.

Another year we shall mow the field grass all around our garden bed as far out from the borders as possible, to keep it from seeding and to provide our small fruits and trees with the layer mulch.

I personally shall pray for strength to face the canning for I know we will be rewarded with enormous fruits in great profusion and shall live to refute the saying, "you lie like a seed catalogue."—*S. H. Henyan, Schenectady.*

Doping The Soil

From "GOOD HEALTH" (England)

THE question of doping the soil with artificial stimulants cropped up again recently in the House of Lords. More than one member, whose families for generations have lived in close touch with the soil, sounded a note of warning. "Our soil has for too long been exploited for gain," Lord Teviot is reported to have said. "Surely crops which have to be doped with stimulants, dressings or sprays cannot impart to those who partake of them resistance to disease if they have to be gingered up to exist."

The Duke of Norfolk, on the other hand, held that "there is no evidence whatever that a proper and balanced use of fertilizers had any harmful effect on the soil or the health of crops and man."

For our part we are strongly of the opinion that vegetables which have been forced along by artificial stimulants are inferior in texture and in flavour to those fed on a combination of stable refuse and well rotted vegetable matter.

There are those who tell us that "the proper and well-balanced use" of tea, coffee, alcohol, tobacco, aspirin, and a host of other doubtful things, will prevent their having any ill effects on the human body. But there are also others of equal authority who hold strongly that in any quantity these things are definitely harmful. Those who recommend them in moderation seldom do so from the purest motives, and it may even be that those who recommend dope for the soil are not altogether free from self-interest.

How to Economize on Fertilizer

BY RALPH BORSODI

Part I

EDITOR'S NOTE: *This is the first installment of a series in six parts by the famous leader of the School of Living at Suffern, N. Y. They will show the advantages of farming and gardening by the organic method. Mr. Borsodi has gathered authentic figures which definitely indicate that it is actually cheaper to farm exclusively with home-made composts as against the purchase of chemical fertilizers. When the series is completed they will be published as one of the official publications of the School of Living.*

EXTENSIVE study of the general subject of soil fertility, of the agricultural practices of various countries, and of experiments with organic fertilizers which can be made by farmers and gardeners themselves, have led the School of Living to the following conclusions:

1. That prevailing methods of fertilization with mineral and chemical compounds are based upon a mistaken conception of the nature of soil, of plant growth, and of agricultural economics.

2. That cash expenditures for commercial fertilizers represent an almost entirely unnecessary item in the cost of agricultural production.

3. That the soil has been robbed of vital organic substance and plant nutrients by the practice of "wasting our waste", both plant and animal. During the last century billions of tons of plant food have been neglected or destroyed in this country.

4. That specialized one-crop farming, combined with chemical fertilization, is largely responsible for the depletion of humus in the soil and the resulting erosion and dust formation.

5. That chemical fertilizers destroy the living soil organisms—both bacteria and earthworms—essential to the manufacture of humus and the maintenance of a healthy soil.

6. That the increasing use of commercial fertilizers (particularly inorganic chemicals) is an important factor contributing to the increase in plant and animal diseases and parasites.

7. That a healthy and prosperous agriculture requires a balanced and diversified program on every individual farm unit—a balance between animal and plant husbandry, and between crop land, pasture and woodland.

8. That any one of several well-established methods of manufacturing humus will furnish all the plant nutrients needed to maintain soil fertility and to produce healthy plant growth.

9. That the farm manufacture of humus (by composting and decomposing manure, garbage and all kinds of plant and animal waste) both reduces the costs of agricultural production and increase profits from farming operations.

10. That composting not only reduces farm expenses but is also a hygienic, economical and practical method of waste and sewage disposal.

11. That only by the conservation and use agriculturally of all refuse and organic waste materials can the natural cycle of decomposition and composition be completed.

12. That only by restoring and maintaining a soil rich in organic matter can we develop a strong and healthy social order in which plants, animals and human beings will develop to the maximum extent their natural resistance to disease and pestilence.

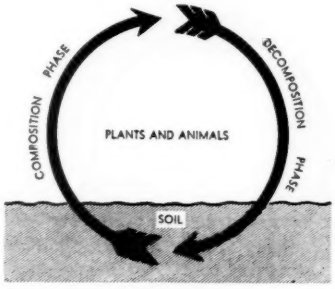
Organic Farming—"The Wheel of Life"

The theory of farming upon which the system of organic fertilization recommended in this Bulletin is based, can be vividly illustrated by means of three charts. This theory considers farming a continuous cyclical process having two equal *and equally important* phases, one-half consisting of the growth or *composition* of plants and livestock, and the other half, of the decay or *decomposition* of plants, animals, and manures. The cycle begins and ends in the soil. The composition phase begins with the roots of plants *in the soil,* and the decomposition phase ends in the decay and dissolution of all plant and animal matter into humus *in the soil.* Organic farming therefore requires the farmer not only to devote thought and labor to raising plants and animals but also to decomposing plant wastes and animal wastes. The real farmer operating upon this theory is engaged, so to speak, in turning "the wheel of life" because he not only produces the food necessary to life but also returns the wastes

of life to the soil from which they originally came.

In a state of nature, the cycle is completed very slowly. But with good farming, it is possible to enormously increase the rapidity with which the cycle is completed and thus to produce larger crops within a given period of time from the same area of land. It is possible to keep up this process of heavy production on the same land indefinitely, without any loss of fertility, *provided the cycle is always completed.* But it is impossible to keep it up very long on average farm land unless the cycle is always *fully* completed. Partial completion results in gradual soil depletion; in gradual loss of fertility. If crops alone are raised, and nothing is done to complete the decomposition phase, very rapid soil depletion results. To speed up plant growth, as we have sped it up with modern methods of cultivation, without at the same time speeding up decomposition and keeping both process in balance on each farm unit, means first declining yields and eventually soil exhaustion; soil, plant and animal sickness; soil mineralization, and finally death to all forms of life.

The process by which the cycle is ordinarily completed by nature before the soil has been cultivated in any manner by man, is illustrated in the accompanying diagram. Composition or growth is only of two kinds, vegetable and animal. On the farm, it means the raising of plants and live-stock though ultimately man is included in the cycle to the extent that he uses the plants and live-stock as food. The process of composition begins with the extraction of humus from the soil through the root systems of plants. The plants then develop to maturity and are used as food in whole or in part by animals. After the plants have reached maturity and produced fruit and seed, they begin to decay and ultimately are decomposed on the ground into humus by fungous and bacterial action. All animals in the final analysis live upon plants (1) and ultimately die. Every bit of plant material and every bit of animal cadaver is thus ultimately returned to the soil in the decay of the plants, in the decay of the flesh, skin and bones of animals, and in the decomposition of their urine and manure.



There are therefore four principal forms of materials, as shown in the second diagram, which are subject to the decomposition phase of the cycle: (a) plant wastes, (b) animal cadavers in some form, (c) urine, and (d) manure. All four must be returned to the soil in sufficient quantities and in correct proportions in order to return a complete and healthy humus. If any one of the four is not returned, humus made from the others is incomplete, unbalanced and sickly. This inadequacy makes itself felt both in declining yields as well as in degenerative abnormalities in the plants. These abnormal and unhealthy plants, their fruits and seeds, in turn produce degenerative diseases in livestock, and of course in the human beings who live upon either the unhealthy fruit and vegetables or the flesh, milk, eggs, etc., of the sick animals and fowls.

Of all the forms of animal life which play a part in this cycle, earthworms are probably the most important. While there are some regions of the earth, in Africa for instance, in which ants perform the same function, most of the top soil of the earth has been manufactured by earthworms. Charles Darwin, in one of his books which followed the publication of his epoch making discovery of evolution, long ago pointed out that in the course of time every particle of our top soil must have passed through the digestive tract of the earthworm. As the earthworm burrows through the ground, and eats leaves and other plant residues, it mixes together (in its gizzard and intestines) minute particles of earth with the food it eats. Mineral substances, not only on the surface but deep in the subsoil, and the organic matter on which it lives, are thus welded together into a homogenous material. Its castings then complete the work of creating top soil, begun by fungous and bacterial action on the organic materials decaying on the surface of the land. The whole of our fertile earth may be said to consist of the manure of the earthworm.

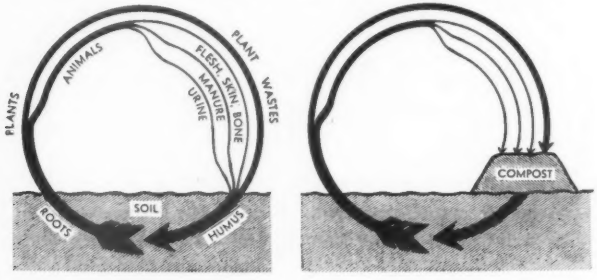
A soil deficient in earthworms, is a soil in process of depletion. Rich farm land should contain millions of earthworms. Darwin estimated that there were 30,000 to 50,000 earthworms in an acre of ordinary soil and that from 10 to 20 tons of soil per

(1) Carnivorous and man-eating animals including man, live primarily upon herbivorous or plant-eating animals. When we eat beef, we are indirectly eating grass and corn since cattle are herbivorous and upon these plants.

acre per year passed through their bodies. Not only are the inorganic chemicals in minute particles of rock, which are essential to top soil formation, brought up from the subsoil and deposited in the form of castings on the surface, but the soil is kept porous and aerated by their burrows. Land rich in earthworms, requires little plowing and harrowing.

In spite of the universal acceptance by scientists of the role played by the earthworm in creating top soil, it is an astonishing fact that almost no experimental work has been done by agricultural scientists with earthworms, and literally nothing is taught to farmers about the importance of maintaining and creating conditions in the soil which are favorable to the development of its earthworm population. It is possible that the silence of present day agricultural science upon this point may be due to the fact that it casts doubt upon the wisdom of using poisonous dusts and sprays, many of which have a deadly effect not only upon destructive insects but also upon the useful and vital earthworms. What makes it seem almost incredible that Darwin's great work, published in 1896, should have been so neglected is the fact that very simple tests prove the value of their presence. In 1906 Darwin's book came to the attention of Dr. George Sheffield Oliver (2) of Fort Worth, Texas, who was so impressed that he immediately set out to test Darwin's statements. In red pots he planted flowers and common garden vegetables in soil carefully sifted of earthworms and their capsules; in green pots he made identical plantings and added a few earthworms. The results furnished unquestionable evidence that Darwin was right.

The plants in the green pots grew much faster; they were stronger, healthier and nearly twice the size of those in the red pots. Equally promising was the fact that, while some of the plants in the red pots were damaged by insects, the pests ignored the more luxuriant plants grown in the worm-worked soil. (2)



For thirty-five years Dr. Oliver has worked with earthworms, restoring worn soils, improving lawns, gardens, orchards and farms. His experience has proven that earthworms cannot exist in soils treated with chemicals and he therefore recommends that none be used—neither chemical fertilizers nor sprays.

In discussing the aeration of the subsoil and the contribution of earthworms, Sir Albert Howard says:

The destruction of the earthworm population by the regular application of chemicals has deprived the land of its natural aerating agencies. (3)

According to Pfeiffer (4) the destructive effect of chemical fertilizers and sprays is so far-reaching that they destroy the microorganic world and the biological activity of the soil. He describes vineyards treated for years "with copper and lime solutions absolutely devoid of earthworms—that is, devoid of the creation of new humus."

Humus Depletion

Unless every particle of material taken from the soil by plants during what has been called the "composition phase" of the agricultural cycle, is ultimately returned to the soil by the farmer and incorporated in it in the form of humus by bacterial and earthworm action, the soil is gradually depleted of its humus. As this depletion proceeds, crop yields decrease, plants grown in the soil become abnormal and sickly, their natural resistance to diseases and insect infestation declines, their nutritional value for both livestock and human consumption is reduced. Humus depletion, in spite of the enormous extent to which it is being practiced in this country, is not always self-evident. It is often concealed by the fact that natural agencies, such as the earthworm, manufacture new soil

(2) "Harnessing Earthworms," Nature Magazine, January 1941. The late Dr. Oliver conducted an earthworm farm at Los Angeles, Calif.

(3) "An Agricultural Testament," p. 136.

(4) "Bio-Dynamic Farming and Gardening," p. 29.

at some rate as long as there is any life left at all and the soil has not been completely mineralized or completely deprived of moisture. Before humus depletion becomes obvious and undeniable, not only must a great deal of the humus originally in a virgin soil have been extracted but the rate of extraction must be continued more rapidly than humus manufacture by whatever fungi, bacteria, earthworms and other natural agencies are still operative. The fact of humus depletion is also hidden by the fact that there are enormously rich soils—rich because they really represent millenial accumulations of humus—such as river bottom lands, which may be cropped year after year without seemingly lessening their productivity. Most of our soils are, however, relatively thin and have only limited amounts of humus in them. On such soils, the effect of soil depletion put in a fairly rapid appearance. In the dry-farming areas of the West, a few years of cropping is sufficient to produce evidence of soil depletion in the form of dust storms and "dust bowls." In regions where there is ample moisture, as in the South, it has taken longer but there is already ample evidence of humus depletion in the wholesale erosion of the soil.

Most farmers today, as well as the farmers of the middle ages and the ancient world, who have had to grow their crops on average land, have been driven to adopt some sort of fertilization program. They have adopted some practices which actually, or seemingly, enable them to farm the same plots indefinitely and so make it possible to establish permanent farm homes. Many different practices, alone or in combination, have been adopted widely for this purpose. Among the most important of these fertilization programs have been the *fallowing* of land (5), the *manuring* of land (6), the *green manuring* of land (7), the application of *chemicals* to land, and the *composting* and application of humus to land. Careful study of the best scientific reports upon these various methods of fertilization has convinced the School of Living that composting is not only the most economical method but also the only method which results in the completion of both phases of the composition and decomposition cycle.

There are many different systems of fertilization with composts. All of them, however, are essentially the same in one respect: all aim at manufacturing a complete and healthy humus by decomposing the wastes used in heaps or pits *before* they are returned to the soil. Comparison of the third diagram with the second one shows clearly the only respect in which the compost method of manufacturing humus differs from nature's method of fertilizing the soil—the materials to be decomposed are converted into humus in a compost heap or pit (8) instead of naturally decomposing on the surface of the ground. Nature's method is, of course, a slow one. As compared with spreading barnyard manure on the land and green manuring (both of which are methods of returning organic material to the soil and manufacturing humus in the fields themselves), there are four advantages in the compost method: (a) practically none of the nutrients in the waste materials are lost; (b) the material spread on the land is not only organic but contains all the nutrients needed for plant growth instead of only some of them; (c) the growth of the crops in the fields is now retarded by the fact that the soil is at the same time trying to decompose the farmyard or green manure, and (d) the speed with which the waste materials are decomposed and humus manufactured is enormously increased.

(5) In fallowing land, fields are cropped for one or more seasons and then left unused to give nature time to restore the nutrients extracted from them. Fallowing was practiced up to the end of the middle ages. It is not only uncertain in its results, but obviously involves a very wasteful use of the land, a third being often left fallow.

(6) In manuring land, manure from livestock is accumulated in the barnyard, then spread upon the land, and usually plowed under. Up to the middle of the 19th century, when chemical fertilizers were introduced, this was the mainstay of all farming and furnished uniformly good results. But it does not result in maximum yields. With barnyard manuring, most authorities estimate that about one-third of the nutrients in the manure are lost. The loss of nitrogen from the manure as it accumulates in the barnyard is a special disadvantage.

(7) In green manuring, crops such as rye and clover, are grown and plowed into the soil while still green, where they decompose and thus add organic material. Green manuring by itself, is not only inadequate but also unsatisfactory for the following reason: when organic matter is added to the soil, two processes must take place before the nitrogen in the organic matter becomes available as plant food. The first, a very rapid and intense action, is the decomposition of the remains, animal or vegetable, by the micro-organisms in the soil. The decomposed matter then becomes incorporated in the soil as humus and the second stage commences when a steady but moderate stream of carbon dioxide is given off and the nitrogen of the soil humus, converted into ammonia, under favorable conditions is transformed into a nitrate which the plant roots can absorb. The requirements of the first phase are so intense that if the process takes place in the soil it is certain to interfere with the development of any crop growing at the same time. The second slow phase can proceed in the soil without harm to the growing crop. With composting, the two phases are separated—the first taking place in the compost heap, and the second which does not interfere with the growth of crops, taking place in the soil.

(8) Heaps are recommended by the School for all climates where rainfall is ample and the fermenting mass does not dry out or cool too rapidly. In climates where rainfall is scant or it is difficult to water the compost heap, pits are preferable. Pits should be shallow. In such climates, a considerable saving of water results from the use of pits. The temperature of the mass tends to remain high and uniform. One of the disadvantages of pits is the danger of water-logging by storm-water, by heavy rain, and by the rise of ground-water from below. This creates a sodden-mass with insufficient air for proper fermentation. Another disadvantage of pits is the labor involved in digging them. They are, however, the only solution for dry climates or regions where there is little rainfall during certain seasons even if drainage channels have to be dug under them to provide against water-logging.

Hints For The Victory Gardener

This is the eighteenth of a series of articles by this author dealing with the cultivation of ordinary vegetables.

BY ROGER W. SMITH

ARTICHOKES

FEW garden vegetables have been less influenced by plant breeders than the two very different kinds of plants known generally as artichokes. In its strictest sense the word "artichoke" means a thistle-like garden plant having an edible head (flower bud). This, of course, is the Globe or French Artichoke, a native of the Old World. The Globe Artichoke is a salad bowl vegetable.

However, because of some similarity in its general appearance, a native American plant, a tuberous rooted, perennial sunflower (*Helianthus tuberosus*) was called the "Sunflower Artichoke" by early explorers. In the course of time, the Italian version of this name returned with the word for sunflower, "Girasole," corrupted to "Jerusalem". Thus our only native North American vegetable became known as the Jerusalem Artichoke.

Jerusalem Artichokes. You will likely wish to try out a small planting of Jerusalem Artichokes because of its valuable root crop. These edible tubers have received much attention recently. They were widely grown and deeply appreciated by the Indians long before the coming of the white man.

Success with this vegetable is practically assured for it remains little changed from its wild ancestors. It is found growing wild east of the Mississippi from Maine to Georgia. However, as with all vegetables, you will find that it pays to have some understanding of the general nature of the plant before attempting to grow it in the garden.

The Jerusalem Artichoke develops a flower-stalk some six to eight feet tall topped by a handsome yellow composite flower about three inches in diameter. In its foliage and general appearance it much resembles other sunflowers. Being a perennial it is best grown in some permanent site where its growth will not interfere with the cultivation of the rest of the garden.

Because the tubers which somewhat resemble white potatoes require a rather long period to reach maturity, the area to be planted should be prepared as early in the spring as the ground can be worked if you wish to harvest them that year. Provided the place is open and sunny, Jerusalem Artichokes will thrive in any fairly good garden soil to which a heavy application of organic humus, compost humus, or well rotted manure, has been incorporated.

Each seed tuber should be set at the bottom of a basin-shaped hole about four inches deep and the hole then filled with mature compost humus and firmed. The seed tubers should be planted three feet apart each way. If you arrange a permanent block of several short rows rather than one long one you will later find it much easier to control the plants which, because of their strong growth, tend to become very persistent when once well established.

The Jerusalem Artichoke is practically free from insect attack and plant disease. In this respect it is much more easily grown than many of our root crops, more especially the white potato whose place it might take.

Although this plant adapts itself readily to a great variety of conditions, it will not produce a maximum crop of tubers during long periods of great heat. It thrives under mild conditions. Under these conditions its heavy foliage tends to shade the ground and to do much to prevent the growth of weeds and make the surroundings favorable for itself. Because of this, you will understand the value of a light mulching of compost material during the heat of the summer to aid in

keeping the soil cool and retentive of moisture.

In the Fall you will naturally approach the business of harvesting your first crop of tubers. This will be something of an adventure. The tall stalks should be cut off close to the surface of the ground and moved to the compost heap. Then the tubers may be lifted with a spading fork.

Under favorable conditions, one hill will yield as much as twenty pounds of tubers, so you might decide that it would be inconvenient to harvest the entire crop at one time. In this case, the tubers may be left in the ground to be harvested when required provided the ground is protected from deep freezing by a heavy covering of brush or similar material. In this way, when you dig them later you will not encounter hard-frozen ground.

That the tubers may remain in the ground over-winter is a great advantage, for they do not have a thick skin and are therefore not well suited for storage.

So that you will have a crop the following year, you will naturally return to the ground a tuber every few feet to serve as seed for the following season's crop. You will do this even though you will find that it is almost impracticable to harvest all the small tubers, and that many of these will remain to grow and form new plants.

Jerusalem Artichokes have been suggested recently as an easy to grow, disease free root crop to act as a substitute in case of a possible shortage of white potatoes which it equals in nutritional value. Grown under proper conditions, through the use of natural humus, it may even be more valuable than the white potato for its starch content is very low. It is also distinctly different in flavor. Whether you use it boiled, baked, or parched as the Indians did, your first crop of this succulent white tuber will serve as your introduction to a delightfully different and truly native and healthful vegetable.

Globe Artichokes: If you have ample room in your garden and find joy in the cultivation of fine salad-bowl vegetables, you will be interested in growing a few of the little known and somewhat exotic Globe Artichokes. The general appearance of this plant is that of a large thistle or cardoon. It is a rather tender perennial but can be carried through the winter with proper care.

Considering the small amount of edible material the plant provides, it occupies much garden space. However, in growing it you will meet a plant still unspoiled by cultivation and closely resembling the wild artichokes found along the shores of southern Europe.

For best results the soil should be fairly light, well drained and quick to warm up in the Spring. It should contain a rather heavy amount of organic humus in order to support the rather rank growth necessary to the production of large flower heads.

In the Spring, after a suitable site has been selected and prepared and after all danger of frost is past, you will be able to start a small planting very easily by securing a few suckers (slips with a heel of root attached and having leaves about twelve inches tall) and setting these about forty eight inches apart each way. They should be planted slightly deeper than they grew when attached to the mother plant. During the growing season the plants should be lightly cultivated and receive a light mulch of compost humus if this is possible. Many of the plants should bear edible flower buds the first season.

Given proper care each mature plant should supply twelve or fourteen large buds and continue growth for three or four years. In its growth each plant will also produce many suckers. These should be pruned away with as little damage as possible to the roots of the mother plant. A few of the best suckers may be retained if you believe you will need them for further propagation.

You should encounter few difficulties in the cultivation of this strong growing plant although you may find it difficult at first to carry the plants through the winter successfully. The knack of doing this is easily acquired. If you are sure that the ground is well drained, that is, that rainwater soaks away rapidly and evenly, all that is necessary is to cover each crown with a pile of fine gravel, sand, cinders, or other porous material at least a foot high. This material should be gradually and completely removed in the Spring. But the real secret of wintering the plants depends almost entirely upon the avoidance of any material likely to hold moisture and promote crown rot.

If you are unable to obtain slips, it is possible to start with a packet of seed. This should be sown in the open and covered with a half an inch of sifted compost humus. The seedlings should later be transplanted and used in the same manner as slips. As you know, starting perennials from seed is a rather slow business. In this case you will have to wait much longer before being able to harvest the first buds. Also globe artichokes raised from seeds usually do not give as good results as plants raised from slips taken from parents of known high qualities.

But whether you start from seeds or slips, even a small planting of this rather little known vegetable will supply you with much delicately flavored material. For best results, some understanding is necessary regarding the preparation for the table of the green flower buds of the globe artichoke.

Immediately after cutting the buds they should be trimmed and dropped into boiling salt water where they should remain until tender. They are then usually drained and placed in refrigeration until needed. The only edible portion of the bud is the fleshy base of the outer bud leaves, the whole of the center bud leaves, and the base of the bud. The spiny center is inedible. The edible portion of the large bud is little indeed. But chilled and served with mayonnaise this little, more than anything else, will make clear to you why the globe artichoke has been called the aristocrat of the salad bowl.

THE COMPOST GARDENER

"The Compost Gardener" by F. C. King, with a foreword by Sir Albert Howard, C.I.E. (Kendal Titus Wilson & Son, Ltd., 28 Highgate, London, England)

ALTHOUGH this informative book of ninety pages is intended primarily for the English vegetable gardener it contains factual material of great value to all gardeners, for it explains many of the great principles of organic gardening. Detailed instructions are given for the making of compost and the growing of vegetables by the use of compost. But the book goes far beyond being a simple treatise on organic gardening for, in stating the results and conclusions of many years practical gardening, it incidentally shows how Mr. King was brought by the trial-and-error method to see the fallacy of chemical fertilizers and to understand the true value of fertile humus.

Speaking of the days when he used artificials, Mr. King says that he noticed: "The physical character of the soil changed rapidly owing to the souring influence of . . . . superphosphates. The land had to be caught just in the right condition for working, otherwise it became knotty. Trenching and ridging were undertaken every year to try and improve the texture, yet each spring found the surface sullen and harsh. The garden was infested with slugs to such an extent that every bit of green leaf was eaten by them; 10,000 onions disappeared in less than a week, and they even climbed the gooseberry bushes and stripped off the leaves."

Speaking of nitrate of soda, Mr. King says: "A gardener whose cabbages were not doing well gave his plants a sprinkling of nitrate of soda, to which they duly responded; later the whole crop was ruined by caterpillars. The cabbages in a nearby garden which received no nitrate of soda were not effected by caterpillars although both sets of plants came from the same seed bed."

"Wood pigeons seldom attack young plants of cabbage, cauliflower or sprouts if they are healthy, but will chose any that are infested with club root, bollweevil, or plants suffering from a check due to faulty transplanting, particularly if they have been artificially watered after planting."

Between the lines the reader is aware of Mr. King's transition from a user of artificials to an organic gardener shrewd enough to appreciate the dangers that irrigation bring.

From the interesting comment by Sir Albert Howard, to the chapter "Preparing and Cooking Vegetables" by Mrs. Gordon Grant, there is much delightful and refreshing reading. One is struck forcefully by the sincerity found everywhere. Mr. King says: "These are my considered views, and the cultural advice given in this book is the result of twenty-five years work in this country. Many readers will, no doubt, disagree with my methods; I frankly admit I have had disappointments and will go so far as to admit that, although I have grown some very good specimens, I have never yet been completely satisfied with any crop I have yet grown."

Which is about the way most of us feel.

Whilst much of the details about growing individual vegetables are not always applicable to the average American Victory gardener—for example, the ne-

cessity for growing tomatoes under glass—their differences are instructive and bring into prominence the tremendous part climate and locale play in gardening. The Victory gardener who remembers how easily he grew cucumbers, will appreciate the difficulties presented to the gardener by a climate that makes the following necessary. "In order to grow cucumbers well," says Mr. King, "a small greenhouse capable of maintaining a high day and night temperature is essential." However, the reader is relieved to learn that the rewards of such a system are relatively great for: "A cucumber house is capable of producing a very heavy crop during the season. . . The average weight of crop per plant should exceed one hundredweight," (approximately one hundred pounds).

Then there are innumerable little comments, such as the one about Vegetable Marrows, a plant not unlike our vine squash. Mr. King says: "As the growths (vines) begin to run, they should be pegged down about every four feet, and when this is done the runner and peg should be covered with fine soil. This enables the runner to form roots."

This, you will agree, is a good idea. But one feels a touch of sympathy for the gardener who is forced because of climatic conditions to hand-pollinate the vegetable marrow flowers. As Mr. King says: "Bees and other insects normally perform this operation, but for the early blooms a little personal attention will be well worth while."

But whether the reader is struck by the cultural differences or is interested in such comment as Mrs. Gordon Grant's: "A very good way to bake root vegetables is to wrap them, when well scrubbed, in greased paper (margarine or butter wrappers are excellent for this), and bake them in a moderate oven till tender. Root vegetables cooked this way are a revelation," the reader cannot fail to be impressed by the fact that this book is the summation of many actual tests made regarding the value of the principles of organic gardening.

Mr. King has learned by experience the true value of organic gardening. He has also learned by experience the fallacy of artificials. Because he has learned the truth, he is impelled to tell us about it. That fact, perhaps more than all else, brings to "The Compost Gardener" its rugged honesty and makes one feel that here, indeed, is important corroboration of the essential value of that ancient method of gardening—Organic Gardening.—R. W. S.

THE SUBSOILER

A speech delivered at the Farmer's Club (London)

BY SIR ALBERT HOWARD

IF time permitted I could have introduced the members of this club to the following results which bear on the live stock problems dealt with in the very fine paper to which we have just listened:—

(1) The mechanisation of the muck heap and the large scale manufacture of compost from vegetable, animal and human wastes.

(2) The practical solution of the nitrogen, phosphate and potash problems of British agriculture.

(3) The reform of the temporary ley including the place of herbs in our meadows and pastures.

But in five minutes I can deal very briefly with only one of the points raised in this paper—the supply of phosphate and the safeguarding and cheapening of that supply. Recent crop scale results have shown that the application of basic slag to pastures and other forms of phosphate to arable land are likely to prove quite unnecessary. Subsoiling gives much better results at a fraction of the cost. There is plenty of phosphate in the subsoil. The problem is to raise it to the surface in the cheapest and best way and then to condition it for the plant. Importing crude phosphates and preparing them for the land are like carrying coals to Newcastle—a sheer waste of time and money which should cease without delay.

More than 50 years ago I began the study of soil by paying great attention to the rocks and

minerals from which all soils arise. The parent rocks contain a good deal of phosphate which finds its way into the sedimentary rocks and finally into the sub-soils and surface soils.

But the unsound systems of agriculture into which our farmers have been forced have led to the depletion of phosphate in most of our soils. The sub-soil however has not been depleted. Neither have the rocks from which the sub-soils arise.

How can we begin to restore the phosphate content of our surface soils? By the use of the sub-soiler followed by the ley containing deep rooting plants, like those used by the late Mr. R. H. Elliot and described in *The Clifton Park System of Farming*. This excellent book has just been reprinted. Copies should be in every rural and school library in this country. We should then encourage the earthworm population to condition and to distribute our phosphates.

The sub-soiler and the deep rooting plant help one another. The sub-soiler shatters the pan under the surface soil, helps drainage and aeration and enables the roots of the plants to penetrate deeper to find the phosphate and other minerals they need and to resist drought. Earthworms also multiply. The deep rooting plants carry on the good work and make the result more permanent. Both these devices will increase the supply and improve the quality of the home grown food needed for building up the very much larger and better herd of live stock this country so sadly needs. Once this is done we can convert all our straw and other wastes into humus and make the fields of this island quite independent of the artificial manure bag. But in all this we need the earthworm whose casts are exceedingly rich in phosphates in just the right condition.

On each acre of land in good heart—at least 25 tons of worm casts are produced and distributed every year. These casts contain seven times more available phosphate, eleven times more potash and five times more nitrogen than is contained in the upper six inches of soil. The role of the earthworm in the soil is to carry the compost idea a step further and to prepare real food for the crop.

Several papers dealing with this phosphate problem and its solution are to be found in the *News Letter on Compost* issued three times a year. I find the club does not yet subscribe to this periodical and that bound sets of the back numbers are not included in the library. Some of these issues are already out of print but I hope to secure a complete set which I propose to present to the club. They contain information not to be found in the agricultural press.

Weed Control in Carrot Fields

Bulletin No. 4, 1942, issued by the California Dept. of Agriculture shows how dangerous it is to use chemical sprays for weed eradication. The following is an excerpt:

WEED control in Imperial Valley carrot fields has presented quite a problem to growers, particularly when late rains postponed control measures and the weeds became too large to be pulled without disturbing the young carrots. It has been found that a *comparatively odorless grade of petroleum stove oil fraction used as a mist* spray afforded satisfactory control for most of the common weeds without serious injury to the stand of carrots, for when no bigger than a match they do not absorb enough of the weed-killing oil to injure them, but the weeds do. Later spraying is inadvisable.

Early in the year reports were received that several carloads of carrots from this district had such an odor and flavor of oil when delivered as to be inedible. Fruits and vegetables are known to retain foreign tastes and odors. The problem is to obtain a sufficiently refined petroleum oil without its being too expensive. The matter was immediately investigated and it was discovered that some operators had used a low-grade kerosene-type oil, and in some instances had sprayed after the carrots had become large enough to accumulate spray in the depression on the crown. Some fields so treated remained to be harvested, and the Chief of the Bureau afforded growers the benefit of experience gained in many seasons of spray residue removal from apples, pears, and vegetables by suggesting that treated carrots be cleaned by means of agitation in water baths containing suitable *detergents*. This was adopted and while there remained a slight odor and taste of oil after the treatment, *it did not prevent marketing of the product.*

HEALTH AND FOOD

THE FOLLY OF RHUBARB

The familiar pieplant, or rhubarb, is used solely for its acid flavor which, unfortunately, is chiefly due to the presence of oxalic acid, of which it contains, as shown by the table, seventeen grains to the pound or more than one grain to the ounce. An ordinary serving contains about three grains of the acid. This amount is not usually sufficient to produce immediate ill-effects, although cases of acute sickness have been reported. But the amount is more than forty times that with which the tissues and the kidney are normally required to deal, and this quantity has been known to bring on acute relapse in chronic nephritis. Since this disease is often present when not suspected, it is possible that the use of rhubarb may be on account of its oxalic content, in some cases a provocative cause of acute nephritis. Sir William Roberts demonstrated that oxalic acid has a pernicious effect upon salivary digestion. A solution consisting of one part of oxalic acid in ten thousand parts of water was found to destroy at once all action of the saliva upon starch. Nearly thirty years ago, the writer very carefully repeated these experiments and was able to verify in every particular the observation of Sir William Roberts. It is evident, then, that if rhubarb is taken along with farinaceous foods, such as bread and other cereals, potatoes, etc., the normal digestive action of the saliva upon the starch, by which about half the work of starch digestion is normally accomplished in the stomach, must fail altogether. In other words, a very important part of the digestive work of the stomach is left undone when rhubarb is eaten.

That the toxic properties of oxalic acid as found in rhubarb are actively poisonous is shown by the numerous cases of poisoning which have been reported in recent times. . . . It may be easily understood that persons whose kidneys have been damaged by an attack of nephritis may be unable to deal with this highly irritant poison even in small amount. There are many thousands of such persons. The victims of typhoid fever, smallpox, and even scarlet fever, measles and diphtheria, rarely escape more or less serious injury of the kidneys. . . . In the opinion of the writer, rhubarb should be relegated to the list of noxious weeds.—*The Vegetarian News* (England).

* * *

RAW FOODS

Dr. T. B. Rice, speaking before the Indiana State Horticultural Society about health through the use of fruits and vegetables says: "One time I discovered the neighbor's pigs in my turnip patch. They had eaten some of the tops off. That wasn't so bad because the turnips themselves were not injured. So I dug up quite a few. What tops the pigs had not destroyed, I pulled off. In throwing away the turnip tops, I threw away all the Vitamin A, most of the Vitamin B, most of the Vitamin D, and all the Vitamin E. I threw away all of the lime, all of the iron, and all of the roughage. Then I took them home. My wife peeled them and that destroyed the Vitamin B. Cooking them destroyed the Vitamin C. Cooking made them soft and so failed to give the teeth the exercise they might have had in chewing and also failed to put the proper amount of roughage into the digestive system. After the cooking even the pigs would not eat them. The right attitude from the health standpoint is to put the food on the table and yell, 'Come and get it.' Emily Post would not agree with this."—*Rural New Yorker.*

* * *

POISONS AROUND THE HOUSE

Poisons are responsible each year for the deaths of some 350 children, or for more than one fourth of the total of 1,200 fatalities from acute accidental poisoning that occur annually in the United States, according to the statisticians of the Metropolitan Life Insurance Company, who base their figures on this company's mortality records.

Many of these children are in the pre-school age and fall victim to sweet-coated strychnine pills left carelessly about the house. Others are attracted by the mint-like fragrance of oil of wintergreen, while a number die from swallowing lye, arsenic or kerosene. Nicotine, bichloride of mercury, digitalis and carbolic acid are some of the other agents of accidental death among the children.

Overdoses of sleeping powders and other drugs and medicines account annually for 250 of the accidental poisonings among adults. A like number die as the result of mistakenly taking a poison instead of the headache

(*Continued inside back cover*)

Short Cuts in Compost Making

BY J. I. RODALE

THERE may be cases where, because of a shortage of labor, the farmer cannot make compost heaps. There may be other reasons why a farmer may not desire to go all-out for the organic method. This does not mean that he cannot practice organic farming. There are compromises that may be resorted to. There are short cuts, many of which under certain conditions may be used to good advantage even by full-time organic farmers.

Every farmer should have cattle and therefore some manure. He can take his first step in the right direction by not using it raw on the land but permitting it to rot first. Any experienced farmer knows that he will get better crops that way. Where cattle are bedded down with sawdust the manure is especially injurious to the soil unless thoroughly rotted first. When any undecayed material is applied to the land it seriously interferes with the bacterial life in the soil so necessary for the growth of the new crop. It actually feeds on the soil.

Sometime ago I described the Organic method to a neighboring farmer. When I met him a few weeks later he said he and his wife had thought about it a great deal afterwards and that I must be right, according to their own experience. "In the old days," he said, "when there weren't any state sanitary regulations affecting the running of a dairy farm, we had a big, shallow pit right outside the barn, and the manure was put there every day. It was allowed to accumulate and rot there for a long period until planting time when it was applied to the land in a fine, darkened and rotted condition. Today the law prevents that so we have to take the daily manure and apply it right to some field in a fresh raw condition. Now, my wife and I had often spoken about how much finer our crops used to be in the old days but we never could think of the reason for it. After what you told me, my wife and I are sure of the cause."

Thomas J. Barrett of Earthmaster Farms, Roscoe, California is writing a book on the *earthworm*. In it is a chapter that describes a natural method of making compost used by Dr. George Oliver's grandfather, part of which is given here because of its intense interest.

"In the center of the barnyard was the compost pit, which, in the light of modern technical knowledge, I now know to have been the most perfect and scientific fertilizer production unit I have ever known. This pit was 50 feet wide and 100 feet long and had been excavated to a depth of two feet. At each end, evenly spaced from side to side and about 20 feet from the end, was deeply anchored a heavy log post, probably 12 to 15 feet high, with an overhead cable anchored to each post and running to the barn. On these cables were large traveling baskets. Thus, each morning the manure from the great barn was transported in these baskets to the compost pit and evenly spread in a uniform layer, by means of the post in each end of the pit, the manure being dumped at the most convenient point for proper handling. By means of these automatic dump baskets and overhead trolley, it was possible to quickly clear the barn of the night droppings and deposit the material in the compost pit without any loss of the valuable elements of the fresh manure. This is a most important point in the utilization of the earthworm for general farm use.

"To one side of the barnyard and at a higher level than the floor of the yard was located the ice pond. This pond was so arranged that it could be filled from a flume leading by gravity from the creek to one end, while at the lower end a spillway was provided so that the pond could be drained. At the proper season, the ice pond would be filled to the proper level and when the ice formed to the proper thickness the annual harvest of ice was cut and stored in the ice house, to provide an abundance of ice for all purposes the year round. The bottom of this pond was formed of a fine-textured red clay. Each spring the pond was drained and with teams and scrapers many tons of this clay was scraped out and diked around the borders of the pond, to weather for use on the compost heap.

"And now enters the earthworm. For more than sixty years my grandfather had farmed this 160 acres without a single crop failure. He was known far and wide for the unexcelled excellence of his corn and other grain and a large part of his surplus grain was disposed of at top or fancy prices for seed purposes.

"As previously mentioned, the pit was 50 by 100 feet, excavated

to a depth of two feet especially to provide a great breeding bed for earthworms. Literally millions of earthworms inhabited this pit. Part of the daily routine of the farm work was the building of the compost heap. Each morning the barn was cleared of the droppings for the previous 24 hours, being transported in the dump baskets on the overhead trolley and dumped on the compost heap, there it was evenly spread over the surface. The flock of chickens everlastingly scratched and worked in the barnyard, assisted by the ducks, gleaning every bit of undigested grain that found its way into the manure and, incidentally adding about twenty tons of droppings per year to the material that eventually found its way into the compost heap. The cattle and sheep used around the four straw stacks and bedded under the shelter of the stacks, adding their droppings to the surface and treading it into the bedding material. From time to time, the entire barnyard was raked and scraped, the combined manure and litter being borrowed to the compost heap and distributed in an even layer on the surface. As the compost was built up to a depth of twelve to fourteen inches, several tons of red clay which had been scraped from the ice pond was hauled in and distributed in an even layer over the entire surface of the compost. Thus, the variety of animal manures from horses, cattle, sheep, hogs and fowl, mixed with the bedding material of wheat straw and oat straw, alternated in the compost heap in layers of twelve to fourteen inches thick, with layers of red, fine-textured clay, rich in parent mineral substance. Meantime, beneath the surface the earthworms multiplied in untold millions, gorging ceaselessly upon the manures and decomposing vegetable material, as well as combining with this diet the mineral clay soil, and depositing their excreta in the form of castings—a completely broken down, deodorized, soil, rich in all the elements for plant life. From time to time, as careful inspection by my grandfather would determine, the compost would be watered from the flume leading from the creek, thus providing the necessary moisture to enable the earthworms to work to the greatest advantage in their life-work of converting compost to humus.

"By the time the spring thaw arrived, the season of the annual plowing, the earthworms had completed their work in the lower layers of the compost heap. The top layer of the heap would be stripped back, revealing the perfect work of the worms. What had originally been a damp, ill-smelling mixture of manure, urine, and litter, was now a rich, dark crumbly vegetable and animal mould earth, with the odor of fresh-turned earth. This material was not handled with forks, but with shovels, for there were no dense, burned cakes of half-decomposed manure. My grandfather would take a handful of the material and smell of it, before pronouncing it ready for the fields. No material that was not completely broken down was allowed to go into the fields and the "smell test" was a sure way of judging material. When perfect transformation had taken place, all odor of manure had disappeared and the material had the clean smell of new earth. At this time of year, at the beginning of the spring plowing, the compost heap was almost a solid mass of earthworms and every shovelful of material would contain scores of worms and as I now know from years of experiment and study, every foot of this material contained hundreds and hundreds of earthworm capsules, which would within a few days of burial in the fields hatch out from four to twenty earthworms each, to immediately begin their life-work of digesting the organic material of the soil, mixing it with much earth in the process, and depositing it in and on the surface of the earth in the form of castings—a finely divided, homogenized soil, rich in the stored and available elements of plant food in water-soluble form.

"In the annual distribution of the fertilizer, my grandfather never completely stripped the compost pit. One year he would begin the hauling at one end of the pit, stripping back the top layers of material which had not been broken down, and leaving a generous portion of the other end of the pit undisturbed as a breeding and culture ground for the remaining earthworms. After the hauling of the fertilizer was completed, the surplus top material was evenly distributed over the entire pit for the "mother substance" and the new compost heap was thus begun. The following year, the hauling would begin at the other end of the pit. Thus, by alternating, there was always a large undisturbed breeding ground to conserve the earthworms for their important work."

In spite of the state regulations the farmer can construct such a pit the proper distance from the barn. He also can anticipate the particular field where he is going to apply the manure and can make manure heaps similar in shape to compost heaps. Some farmers cart their manure daily to the fields but make too small piles which are left over the winter and much of the nutrients are lost. Beside sun, wind and rain, the freezing of these little

heaps causes serious losses. The piles should be large and a covering of straw will help to protect them against the elements. They should be placed on a high spot which will not be washed by running rain-water. Barns are usually so constructed that the urine of the cows are drained into a pit. The farmer can greatly enrich his manure heaps by impregnating them with this liquid. Fresh urine should never be applied directly to the land.

Clubroot is encouraged by the use of raw manure. In a case where celery and sweet peas were grown in a trench with unrotted manure at the bottom, the crop was very poor due to the disruption of the roots by worms.

Dr. Ehrenfried Pfeiffer in "Biodynamic Farming & Gardening" (Anthroposophic Press) says, "In such raw, immature manure, the strongly smelling products of partially disintegrating albumen and nitrogen compounds have not been completely consumed, but have been taken up by the plants directly from the soil. Aside from their odor, these compounds also have certain harmful incidental effects on the living things in the soil, and on the plants themselves (promoting susceptibility to fungus diseases) and when eaten, on the human organism. The result is digestive disturbances, producing heartburn, bloating, and if the process goes far enough even causing infection with intestinal worms. These worms are to be observed in the muck when the night soil fields near the cities are drained. Many stomach and intestinal disturbances are cured without treatment when the use of vegetables fertilized in this way is discontinued."

The farmer can go a step further now if he so wishes. He can make regulation compost heaps in the field; that is, in addition to manure he may add green matter such as weeds, leaves, grass clippings, etc. He would then also use some earth and lime or wood ashes and follow our instructions in regard to the method of assembling these materials. But he doesn't have to turn the heaps. Since he doesn't have the time to do that he will have to wait longer for the heap to decay. To do a good job without turning the heap would require about two years but no doubt after six months or a year he will want to put it on the land. Even at this stage it will be much better than raw manure. And by applying green matter to the heap, he is multiplying his available fertilizer by two or three hundred per cent. He is also aerating the heap as well as adding nutrients because animal manure by itself is unbalanced and not a complete fertilizer. When he is ready to use the heap he peels off the outer layer and uses it to start a new heap.

Another short-cut, if necessary, would be the placing of extra heavy bedding for cattle such as steers in the barn. Ordinarily, manure contains straw or other bedding to which is added other green matter in the compost heap. If you are not going to make compost, you can let your cattle do the work for you. By giving them an extra-heavy bedding, and having them thoroughly mix the mess together by treading, you will have most of the ingredients of the compost heap. In this case do not clean out the barn as often as you do ordinarily. When taking out the manure, place it in neat piles and allow it to rot.

We can go still further by sprinkling earth mixed with lime or wood ashes in the bedding every day or so right in the barn. We then have all the ingredients of the compost heap, animal matter, green matter, earth and a neutralizing base. The aeration, however, would be poor. This could be offset by turning the bedding in the barn every few days, if there is sufficient time. This may be good practice in the winter when more time is available as a rule. Apply new straw after turning.

In the chapter describing a new type of chicken-dropping pit there is mentioned a system of leaving the manure in the steer-barn all winter. New straw is put down about twice a week and the steers trample it thoroughly in. As time goes on the manure rots from the bottom up due to bacterial action and in time becomes fairly well rotted. We have followed this method for the last two years and have not cleaned the barn out for over eight months at a time.

I would like to quote from a letter about "Yorkshire Foldyards" received from F. C. King of Levens Hall, Westmoreland, England:

"The system you describe of keeping steers in a barn has been an accepted principle here for centuries, the only difference is that where you speak of a barn we, in our part of the world speak of covered-in fold-yards. Another difference may well be that, whereas you only mention steers, we run pigs, calves, lambing ewes etc. in these fold-yards. Poultry also have access so that we get a very good balanced mixture of dung and urine.

"Generally speaking our fold yards are empty round about April—all the dung by that time being cleared out and on the arable land. Usually the fold yard is in the form of a square or rectangle which is completely roofed in, and all stables and cow-sheds, pig sties, etc. are built on the outside, but always with one door into the fold yard, so

that when these places are cleaned out—which in the case of the milking cow sheds is every day, all the dung and soiled bedding is taken through the door into the fold yard. During the summer months, when most of our stock is out, little manure is made, the bulk being produced in Winter when practically the whole of the live-stock belonging to the farm is in-doors. The centre of the fold yard is always lower than the sides, forming a pit.

"The side walks, which may be anything from nine to twelve feet wide are cobble-paved, which I can best describe as a lot of small hard stones set close together on edge, exactly like a lot of our small market town streets and market places which some of your readers may have seen. The base of the fold yard, however, is seldom paved but is just the bare earth. You will at once see the benefits to be derived from this system. All through the Winter the level of the centre gradually rises and is a mixture of all animal excretions and urine, together with a certain amount of soiled bedding. Natural composting is carried out on the floor of the yard, which is abundantly supplied with soil-bacteria and microbes. A steady even fermentation is excited all the time with an absence of offensive odours.

"Large troughs are scattered about for the feeding of the various stock. Steers—or as we call them bullocks—are fattened for Christmas sales, also many pigs which run about amongst the stock, picking up a lot of food which the stock drop, and generally act as scavengers. In our country a Yorkshire farmer is considered a very good man indeed, and I hold the belief that a lot of his success is due to the care and the general management bestowed on his manure. In other parts of England this is not so, and the spectacle of manure being heaped up outside cow-sheds etc. is all too common and is to be deplored. Under these conditions much of the original goodness of the manure is lost and more particularly the urine, which is far richer than the solid dung. The heap develops a most unpleasant smell, and is a breeding place for all kinds of flies. Heavy rains wash out a lot of the goodness which finds its way to the drains by devious routes. Wind and sun alike interferes with the fermentation. The ammonia evaporates and the final product is unsatisfactory."

There is a method called *sheet composting* by which compost is made in the fields in one application. Sir Albert Howard describes this in the "Agricultural Testament." He says, "In exceptional cases, however, it is possible to carry on the manufacture of humus in the soil without any risk of temporary failure. One British example may be quoted. On some of the large farms in the Holland Division of Lincolnshire peas are grown as a rotation crop with potatoes. The problem is to manufacture humus before the next crop of potatoes is planted. This has been solved. Early in July the peas are cut and carried to the shelling machines where the green seeds are separated and large quantities of crushed haulm are left. Immediately after the removal of the peas the land is sown with beans. The crushed pea haulm is then scattered on the surface of the newly sown land followed by a light dressing of farm-yard manure—about 6 or 7 tons to the acre. The beans grow through the fermenting layer on the surface of the soil and help to keep it moist. While the beans are growing humus is being manufactured in a thin sheet all over the field. At the end of September, when the beans are in flower, this sheet composting on the ground is complete. The green crop is then lightly ploughed in together with a layer of freshly prepared compost. Humus manufacture is then continued in the soil. The beans under these conditions decay quickly; the process of humus manufacture is completed before the planting of the next potato crop."

In connection with a hay crop when it is about to be plowed up for a cultivated crop sheet composting may be resorted to. In the last year in hay directly after the first cutting, a layer of manure is applied to the field, and the grass grows right through it.

It is our practice after growing corn, to flatten the stalks as soon as possible. We go over the field with a cultipacker or roller, and then disc. Many farmers leave the stalks standing all winter. Where corn stalk stubble is flattened the snows lie on it and saturate it. The rains impregnate it. Snow is called "the poor man's manure" because it contains nitrogen and other valuable elements, and the flattened stalks serve to collect snow. When rain water starts to flow, these stalks not only slow down its velocity but also remove earth that is contained in this moving water. Since the corn crop residue is extremely heavy it is liable, when plowed under, to interfere with the next crop, so we always "fallow" that field in this manner: We merely disc the ground a few times and plant a green manure crop such as clover or soy beans, leaving the corn stalks in the surface to catch rain

water. We spread manure over the fields as early as possible as a sheet compost and in July or August plow everything under. In September we then plant wheat or barley.

The degree of success of sheet composting depends to a great extent on the fertility of the soil. It will do poorly in an extremely dry season.

The organically minded farmer, who for some reason does not adopt our method root and branch should be partial to such fertilizers like raw ground phosphate rock, lime, dolomite, etc., substances that are not strong, corrosive chemicals, and which do not kill off earthworms.

As far as the gardener is concerned there is usually no problem because of the small area tended. But still from time to time he may adopt in a small way some of the ideas described here.

Magic Results From Mulching

BY J. SYDNEY CATES

Reprinted by special permission from The Country Gentleman, copyright 1942. By The Curtis Publishing Company.

Recent experiments show astonishing value in the use of straw and other litter on many growing crops.

FOR many long years tillage and dust mulch have been central themes in agricultural orthodoxy. Yet, while much has been said, surprisingly little of an experimental nature has been done about these matters.

Thirty years ago, while in research work with the Department of Agriculture, I published a comprehensive thesis on the relation of weeds to the tillage needs of corn. The study showed that, if you keep weeds and grass out of a cornfield, cultivating the ground after the crop is planted does no good at all—that frequently it does harm. That thesis was fought for a long time, but finally it has been accepted by practically all research institutions in agriculture.

Of course, laying the ghost of the dust mulch, and of the value of tillage as such in promoting the growth of row crops, leads us right up to the theme of what can be done to keep down row-crop weeds and grass if the cultivator is going to stand idle. Present-day developments in the use of a litter mulch, heavy enough to smother out weeds and grass in row crops, seem to point not only to a new practice which may become of vast importance to agriculture—particularly the horticultural side of agriculture—but also to a new understanding of ideal growth conditions for plants.

The mulch put on in lieu of cultivation is resulting in crop growth performance so startlingly superior to what we got from clean cultivation that it is difficult to explain what has happened. Precious little has been published about these mulching experiments; in fact, many of them are not official research projects, but they add up to a startlingly hopeful array of facts.

Two years ago I reported on the work by Dr. George M. Darrow and Dr. J. H. Clark in bringing the modern blueberries up out of the swamps and muck land and growing them successfully, under mulch, on most any upland soil. But the blueberry is a special crop, supposedly with all sorts of mysterious requirements for best growth, and nobody seemed to think that this incident might fit into a general mulching picture. Apparently, however, that is just where it does fit.

Last summer at the New Jersey Experiment Station I viewed even more striking results from mulching tomatoes. In a typical experiment the clean-cultivated tomato plot produced at the rate of thirteen tons to the acre. The mulched plot alongside produced just double—twenty-six tons to the acre. Sweet potatoes and several other New Jersey crops have shown the same striking growth increase under mulching as compared with ordinary clean cultivation.

Potato Yields Doubled

Having in mind the drought

conditions last summer, I suggested to Doctor Clark that these striking yield differences between the cultivated and the mulched plots might be due to the moisture-holding effect of the mulch. But apparently the explanation is not so simple, because Doctor Clark came back with the amazing announcement that the mulched plots always show up to their best advantage when the season is extra wet!

And then he suggested another and even simpler explanation. Cultivation prunes the roots out of the first four or five inches of the soil, and surface drying after the cultivation season is over tends to keep roots low. Under the mulch covering, however, the roots have access all the season to this rich top five inches of soil, and simply thread it full of feeders.

In the maze of factors which add up to good or bad growing conditions we are very prone to pick out some for study and forget all about others. I am inclined to think that soil bacterial population and activity have much to do with this vague thing we call soil fertility. And while no soil bacterial studies that I can find have been made for soils under mulch as compared to clean cultivation, it is generally recognized that the bacterial flora is vastly greater in the covered soil. In fact, it is common observation that mulched crops must have an abundant nitrogen fertilizer supply, else the crop will show temporary nitrogen starvation. This is true because soil bacteria stimulated by the better growth conditions under the mulch tend to gobble up available soil nitrogen. Of course, these tiny motes of vegetable life soon die and decay, and give back to the soil quickly available higher-plant food. But there is a lag when you first mulch during which they need to be fed extra nitrogen. The bacteria, though, are more than worth their keep.

The New Jersey Station has got excellent results from growing small blocks of peaches and grapes under mulch. They have used, in the main, marsh hay. Straw or any available cheap roughage would serve the same purpose.

Many years ago, down in Southwestern Kentucky, I encountered an excellent farm practice in using a straw mulching to secure a perfect stand and growth of red clover seeded on wheat. Straw was scattered thinly over wheat fields in the fall when wheat was just coming up, or even after it had made considerable growth. The straw, of course, was not spread thick enough to smother the wheat. Late winter seeding of clover on this straw-mulched wheat, always resulted, I was told, in a perfect clover stand.

Throughout the South during recent years, the Soil Conservation Service has successfully used mulching to get lespedeza established on land so poor and eroded as to appear almost completely worthless. In one of their reported experiments, a galled, semigullied area was levelled off and seeded to Kobe lespedeza, given a fair dose of phosphate and then coated with a straw mulching. The lespedeza responded with a two-ton hay yield, and then matured a seed crop to give a thick volunteer stand and even better growth the next season.

I have repeatedly seen the rank-growing perennial, Lespedeza sericea, established and growing carefree under similar conditions and treatment. This method for getting such sods established on apparently impossible land seems to be absolutely sure-fire.

While the use of mulch in starting sod crops under hard conditions is a device of vast practical value, perhaps the greater number of farms throughout America can make their best beginning with mulch on home garden, orchard, and small fruit crops.

Not only has the blueberry responded to mulching on upland soils but later work by Doctor Darrow indicates that the fine-quality red raspberries, when grown under a similar mulch, will perform in excellent fashion far outside the normal range of this somewhat regionally temperamental fruit. All the berries and small fruits thrive amazingly under mulching.

Mulching apple orchards is an old, old practice in many sections of the country. In New England, commercial orchardists pay six to eight dollars a ton for low-grade hay to use in orchard mulching. In the West, also, large quantities of low-grade alfalfa hay are bought for the same purpose. As a rule, commercial orchardists are well informed about the practice and value of mulching. What I am particularly keen about is the expansion of the mulching practice to the millions of noncommercial home orchards, gardens and small-fruit plantings.

Mulching in one lick at the job solves the weed problem, the cultivation problem and the erosion problem, and at the same time brings outstanding yields. Furthermore, the ordinary farm has enough available straw, low-grade hay or other roughage available to carry out a mulching program on a few acres.

I have talked with a number of forage-crop men about the

possibility of profitably growing certain types of forage just as a source of mulching material. Throughout a great part of the north country, Reed Canary grass makes an enormous tonnage, though the forage is not of the highest quality for feeding purposes.

South of the Ohio and Potomac, Lespedeza sericea will make two to five or more tons of dry forage on soil that would seem famine ration to other crops. In the Lower South, crotolaria makes phenomenal growth under soil conditions too poor for success with most planted things. In fact, most every section of the country has some well-adapted, rank-yielding forage-crop variety that will furnish an abundance of mulching at low cost.

There has been precious little definite experimenting done with this mulching scheme of growing crops. And the experimenting, as a rule, has been fragmentary. Only a small portion of what has been done has been published in scientific papers. But during the past couple of years I have heard more enthusiastic discussion of mulching by top-flight horticulturists, erosion-control specialists, and agronomists than I have about any other phase of the production side of farming. Equally as amazing as the phenomenal growth response from mulching has been the effect in stopping sheet erosion. Sloping soils that have been peeling off from the surface at every rain, stay strictly in place when given even a slight coating of roughage.

And soil students now claim that the pounding effect of the raindrops puddles and packs the surface soil in a deleterious way. This is prevented when mulching material instead of the cultivator is the device for keeping down weeds and grass in row-planted things.

A number of years ago, that distinguished scholar, the late G. N. Collins, who headed the Biophysical Laboratory of the Department of Agriculture, carried on extensive studies in an effort to find out just how mulching served to make plants grow so much more vigorously. But the farther Collins got into this problem the more mysteries he uncovered. The work of Collins has never been published, because he never succeeded in nailing down an answer. Collins repeatedly got the same stimulating effect from mulching no matter whether his experiments were in the open field under just such weather as happened to come along or in the greenhouse where temperature and moisture were kept under complete control. As a matter of fact, the mystery reached a new height as the work went along, for Collins finally found a very pronounced stimulating effect by covering a little greenhouse flat of soil with paper for a few weeks and then removing the mulch paper when seed was planted. Dr. Lewis Flint, of the Collins staff, later encountered an accidental field experiment that checked these novel greenhouse results: A Florida truck grower making his first trials with mulch paper, spread his rolls of paper several weeks before planting time. But he did not fasten the paper down very securely, and a violent storm came along and blew it all away. The truck crop planted where the paper had been, however, showed a strange stimulated effect throughout the season.

Maybe some day we will understand how mulching effects this striking stimulation of plant growth. Maybe a new principle in plant physiology lies hidden here.

Digging The Garden And Soil Fertility

BY ROGER W. SMITH

THE good gardener has a more than academic interest in the recent much-publicized claims that the old-fashioned plow is destroying soil fertility. He makes a ritual of the turning over of the topsoil of his garden every spring. He digs deeply to keen his conscience clear. He pulverizes his soil with care. Any doubt regarding the value of plowing is a serious matter. If plowing is harmful and unnecessary, then all the labor expended in the digging of his garden is equally without value.

Nature does not plow. Rock gardens, lily ponds, and front

lawns thrive without much disturbance from farm implements. In the rotation of farm crops there exists a rule that the longer an area put down to grass remains undisturbed, the deeper will be the beneficial, accumulated humus layer. This would seem to show that digging or plowing are unnecessary. Suppose we investigate this matter.

What is the value or purpose of digging, plowing, or otherwise disturbing the humus layer of the garden?

The effect of digging and plowing are much complicated by the part various mulches play in preventing soil losses due to wind and weather and the damage caused by erosion. Any true consideration of the value of digging a garden should be made without including these other factors. The purpose of digging should be kept separate from the purpose of mulching and other soil conservation practices. The fact that the farmer on the steep hillside has to plow in a certain direction to conserve his soil and the fact that the plainsman has to leave a heavy mulch over his acres to hinder loss from wind, have no bearing upon the actual effect digging has upon the garden. The good gardener seldom plants his garden upon a hillside so steep that erosion is a problem, he usually sees that it is placed in such a protected place that loss of soil from wind is impossible.

What purpose does digging serve? Its most obvious purpose, of course, is the necessity for hindering weedy growth and the burial of manure, green manure, undesirable plant residues and the like. But this is not its most important purpose.

Digging loosens up and increases the aeration of the soil. It causes the exchange of oxygen from the air for the carbon dioxide coming from various soil processes. Oxygen is urgently needed for the breaking down or oxidation (actually slow burning) of organic humus. The loosening up of packed soil also brings about a more uniform distribution of soil moisture. It greatly increases the ability of the soil to absorb and hold moisture. The activities of various beneficial soil microbes are greatly increased because of this condition which is most necessary for their greatest activities.

Digging makes it possible for the micro-organisms to speed up the decomposition of plant residues because of their greatly increased admixture with the soil. Actual tests have shown that the development (increase in numbers) of beneficial bacteria is much improved by the disturbance of a given amount of soil provided arrangements have been made for the retention of a fixed and adequate amount of soil moisture. The effect of the stirring at given intervals of a given amount of fertile humus is most startling. A very well known test has demonstrated that where two million bacteria per gram were existing when the stirring of the soil commenced, this number was increased to over twelve million per gram within twenty-four days simply by stirring.

Digging a garden is probably even more beneficial so far as the lower layers of the topsoil are concerned because these suffer most through poor aeration and because they have long been left undisturbed.

Thus it would seem that the effects of digging the garden are entirely beneficial. Unfortunately this view is rather superficial, and incorrect at least in part. It has often been demonstrated that the disturbance of the implements of culture can so speed up the breaking down of a fertile humus as to reduce it in a few seasons to an infertile dust.

True enough, plowing, digging, and otherwise disturbing the humus layer increase beneficial microbial activity. They make a heavy and uniform crop possible, but they do it at the expense of the humus layer. They speed up the mineralization (breaking down) of this all important material. Digging the garden and the resultant plant growth cause a very definite loss of organic humus throughout the cultivated area. This loss is most noticeable in a garden which has been cultivated over a number of years. The level of the garden is invariably lower than the surrounding land; it is definitely lower than the original garden even though only a small amount of vegetation has been removed by cropping.

Practically all land in a wild condition is capable of supporting a certain amount of vegetation. The amount may vary greatly. Roughly, this ability of the soil to support a given and varying amount of vegetation is known as its "biological pressure". The biological pressure of tropic lands may be high, of northern deserts it may be low. The rock garden, the lily pool and the lawn are seldom plowed, dug, or otherwise disturbed because their biological pressure is sufficient to produce the small crop desired.

But the object of a vegetable garden is to supply as large an amount of edible vegetation as possible within a very limited space, an amount far in excess of the area's biological pressure. This has to be produced even though its production exhausts all available humus. For the good gardener does not hoard his garden's organic humus by

permitting his garden to stand fallow, he develops it to its utmost and ponders ways in which the used-up humus may be replenished. How may heavy losses of fertile organic humus best be replaced?

Many methods have been in use since the dawn of gardening. Animal wastes (manure) have been returned directly to the soil. Green manures (the plowing or digging under of crops grown for this purpose) have been long used. Both of these methods present the same difficulty. The material used is usually crude, it has to be slowly digested by the soil before it is available for the use by the plants. It has to be decomposed slowly in the soil before the soil processes can present its result to the roots of plants.

This difficulty is easily overcome by properly composting all vegetable and animal residues. The action of composting produces, much more quickly and more satisfactorily than the slow processes of soil decomposition, a clean, rich, ready-made humus instantly available to replace humus loss. Composting reduces plant and animal wastes to a mellow, friable humus, rich in soluble plant nutrients. Relatively small amounts of this substance will more than replace loss of humus caused by digging of the original garden bed and the resultant increase in plant growth.

But regardless of the material used to replace this loss the digging of the garden will always be necessary to increase the action of favorable bacteria so necessary for the production of a large and satisfactory crop of healthful vegetables.

TOMATO COMPOST

BY A. R. WILLS,
Tadburn Nursery, Romsey, Hants. (England)

AT this Nursery we grow 10 acres of tomatoes under glass besides cucumbers, and other crops. It will readily be understood that there is a tremendous amount of waste material, such as trimmings from the tomato and cucumber plants, and waste from other crops. There would be at least 400 tons of green material to get rid of during the course of the year.

This presents a very great problem as may be seen at many glasshouse nurseries, where in some cases ¼ / ½ acre of land is devoted to a dumping ground of this material, and these heaps are most unpleasant, as there is nothing worse than tomato refuse in a rotting heap—the smell is very great.

Since we started composting the whole of our refuse in pits as advocated by Sir Albert Howard, we have nothing in the way of rotting heaps or any other kind of refuse heap on the place; in fact, our only trouble is that we have not enough refuse.

The method of dealing with this refuse is in ventilated pits 14 feet x 28 feet; the refuse is built up in layers about 18 inches thick with a small layer of horse manure, and then another 18 inches of refuse, and so on, until the heap is about 4 feet high.

This heap, owing to the fact that there are ventilating channels underneath, will permit the air to pass right through it, supplying the oxygen which starts the bacteria and fungi working, and in a few days the temperature has risen to 160 degrees.

At the end of three weeks this heap is turned over, care being taken that the outside is thrown to the middle, and that the heap is turned up loosely. The temperature again rises to something over 100 degrees. For another three weeks the heap remains untouched, at the end of which time it is again turned, and is left to stand a further three weeks. At the end of that period it has worked down to a short even mass, resembling well turned stable manure.

Whatever material is used that will rot, it will turn into humus; we have put into a pit thick cabbage stalks, and even a load of banana stalks, and these have all rotted down into humus.

This compost we have used in tomato houses for several years, and in spite of the fact that plants affected by disease are put into the heap, no ill-effects have been traced. If it were only a means of getting rid of the waste material, we consider it would be worth while, but in addition to this advantage we are getting a very large quantity of most useful manure. From each pit about 8 to 9 tons of the finished product is turned out, and about 30 cwt. of stable manure is used to produce this.

EDITOR'S NOTE — Dr. Pfeiffer states that the tomato is one plant that thrives exceedingly well on compost made from its own residues.

Reader's Correspondence

Please write on one side only. Do not make your letters too long. Put each different query on a separate sheet. Send stamped, self-addressed envelope for reply.

SOIL (Woods)

In addition to the compost which I have all ready for spring. Would it be advisable to bring in top soil from the woods and spread it in the rows where I am going to do my planting?

Answer

It would be an excellent thing to get the soil from the woods and spread it in the rows, but there are certain precautions. Soil from the woods is usually acid and should be mixed with lime before using. Also be careful not to take too much soil from any one place in the woods because it will hurt the trees and the soil. Possibly you will have to decide for yourself how much to take, based on the richness of the top soil.

POTATO (Seed)

Where can I get some potato seed that I can plant whole, as you told about in a recent issue of Organic Gardening? I would not need more than a peck at the very most.

Answer

Regarding potatoes that you could plant whole, this may consist of the regular potatoes that are purchased for planting, in the regular trade sources. However, you might ask for a smaller potato that might be used for this purpose, as they are cheaper and probably better for the purpose.

SOIL STERILIZING

I am enclosing a newspaper cutting which I hope will interest you sufficiently to read and comment on.

Answer

Thank you very much for your letter and clipping enclosed. The article was very interesting. However, the method described is so artificial that I am sure that anyone, who has a love for the soil and who would like to produce food that would be healthy to consume, would not want to use such a method. In fact, the grower, himself, says in the article that "It has received so much stimulation from artificial sources that it can no longer really be called soil".

The soil is boiled for an hour and 25 minutes and then there are steam heating pipes underground which keep it warm. The gentle heat of these pipes might not be bad although they might permit certain bacteria and molds to grow beyond the natural requirements. The boiling, I am sure, is definitely detrimental in that it kills off beneficial organisms.

TANKAGE

My type of farming is confined almost in toto to muck or peatland farming. This soil will burn if a lighted cigarette or live spark is allowed to remain on it in very dry weather. *There are a few but not many earthworms in it.* This is likely due to heavy applications of commercial fertilizer for the last thirty years.

We have used tankage of about one ton per acre though on occasion and I thought it was a good measure because the mice around the place always were attracted to it and would eat a certain amount. The latter experience has never happened to my commercial fertilizer as far as I know. *Can you tell me if tankage is food or poison to the earthworms?* I tried out a few in a box and they either escaped for want of moisture or died. I have never found a trace of them.

Answer

There is no question that the use of chemical fertilizers has cut down the amount of earthworms.

Tankage is an organic material being a by-product of slaughter houses, but it is best to use it with a rounded-out formula of other materials such as bone meal and wood ashes. Tankage contains mostly nitrogen; naturally the mice eat it because it is animal matter. I would not say that tankage is poisonous to the earthworms, but they might not relish being placed in the midst of such a concentrated product. In other words, an experiment in a box could not be the best way to determine that point. Where you apply some

tankage to the soil, the earthworms might shy away from it until it decays to a certain point, but it certainly would not kill them. They would die for want of moisture in your box as you say, but that would not duplicate the condition as an earthworm would find it in the soil.

FERTILIZING ORCHARDS

How do you apply compost to fruit trees, it is spaded in or thrown on top of the ground and covered?

Answer

The best way to apply compost to fruit trees is merely to apply it to the surface of the ground without spading it in. Start one foot away from the trunk of the tree, and go to about two feet beyond the drip line of the outer branches, then this compost should be covered with a straw or hay mulch, perhaps 8 or 9 inches thick. It will take a year or two before you will see results, but you will be amazed later.

EARTHWORMS

The angle worm side of the question interests me. I spent a year in northwest Montana after my last year in college. Unless the soil is irrigated it is arid, dusty and desolate. My cousin-host who was a cattleman there visited his old home in Michigan and actually shipped a large box of earthworms in their native earth back to his house garden in Montana. The results soon showed in a better garden.

Elizabeth P. Dowling,
Birmingham, Mich.

COMPOST

From a letter received from F. C. King, the Gardens, Levens Hall, Westmorland, England.

The reference to earthworms interests me immensely as I believe far too little credit is ever given to these lowly creatures for all they do for mankind. The multiplication of the earthworm population in these gardens has long since claimed my attention. I look to my compost heaps to feed and maintain my worms, believing if compost did nothing more for the garden than provide sustainance for worms all the labour incurred in making compost would indeed be well spent. The little things in life is what we must ever watch, as the big things may never come. A very important incident in the making of compost is often overlooked by the enthusiastic beginner and that is choosing the best place to make the heap. Always compost on the same site for success, so make sure the right place is selected for a start. The soil-base of a compost heap is quickly impregnated with micro-organisms which are so necessary for breaking down the material that is being composted.

This material should be as varied as resources permit, but should consist of a proportionate amount of woody material (well-flattened), which is necessary for the production of fungi, without which no compost is possible. I find sawdust of the utmost value and use many tons, and have never found it at all necessary to exclude resinous saw-dust. A compost is as good as the material, therefore see that all bits and pieces find their way into a compost heap. Particularly valuable are used tea-leaves, for they are the best worm-breeders I know. I aim to make 200 tons of compost for four acres of garden for 1944, although my staff is reduced from ten to three including myself.

One thing I would like to make clear—it is not necessary to use Sulphate of Ammonia or any compost-maker. I have made hundreds of tons of excellent compost without purchasing a thing, but using only animal manure and waste vegetable matter. The insoluble residue from artificials will poison land. Sulphate of Ammonia and Superphosphates on many types of soil are just so much poison, and kill soil bacteria and earthworms.

SOILS (Clay)

What is needed to change half clay soil into a good rich soil in the shortest time?

Answer

In connection with changing half clay soil into a good rich soil in the shortest time, it could be done by incorporating as much compost as possible in it. If the place is not too big, you can put a lot of peat moss in, in addition to compost. This can be purchased at nurseries and garden supply stores.

Some people put sand into a clay soil to get it more porous. That is satisfactory, but it would not be advisable to include coal ashes, which so many persons do in cases like yours, as coal ashes contain strong substances which are not good for the soil. The more compost or humus you can put into the soil, the better.

You might also grow a green manure crop such as rye grass and plow it under in the fall. At this time if you can charge the soil with earthworms, they will not only quickly break down your rye grass, but will aerate and pulverize your soil.

KITCHEN CUTTINGS

For several years, I have been putting non-greasy, raw vegetable refuse through my grinder. The liquid that drips from the grinder I dole out to seedling plants just sprouted indoors. *The chopped refuse scattered over the surface of our kitchen garden quickly and unoffensively becomes part of the soil.* But, it seems to me that *strange, new insects have appeared as hot weather arrived.* Could these have developed from eggs hidden in vegetables shipped into Illinois from Texas, Arizona, California and Louisiana?

Mrs. R. O. Becker,
Peoria, Illinois.

Answer

I am sure that your trouble arises from putting raw material on the soil. You should first compost the garbage and only finished compost should be used on the land. Where raw garbage is placed in the compost heap properly, the heat of the compost will usually take care of any insect eggs in the material. Even the liquid that drips from the grinder should not be used on your seedlings. Impregnate your compost heap with it and let it decay in it. As a general rule, never use any raw material as a fertilizer. Let it rot or mellow first.

BACTERIA (Inoculating)

The nitrogen fixing bacteria sold for "inoculating" various legumes is supposed to be a peculiar strain suitable to the particular plant in question.

There is a strain for alfalfa and clovers. Another for peas—except cow peas—and velches. Another for garden beans. Another for cow peas or field peas and lima beans and so on ad. infinitune.

What puzzles me is what would happen were one to take some of all these "strains" and mix them up? Would they eat each other up?

Is there really any difference in these various "strains"?

Why wouldn't the bacteria which fixes nitrogen nodules on a cow pea and lima bean do the same thing for alfalfa and clover?

Why should soy beans require a different bug to produce nitrogen nodules on its roots than any other kind of bean?

Now I'm not just trying to "be funny" I'd really like to know the answers and "why?"

Are there really a large number of different kinds of nitrogen fixing bacteria that live in the earth?

A county agent—not long ago—advising people regarding the planting of Vetch stated that when the seed were treated with inoculating bacteria or nitrogen fixing bacteria before planting, the plants were able to gather their required nitrate from the air, while plants from untreated seed were forced to obtain their nitrate from the soil thus depleting the soil instead of benefitting it.

J. C. Stephens,
Tyler, Texas.

Answer

There is no question that the inoculation of a leguminous crop with specific bacteria is beneficial. Old timers, however, advise that where you want to grow a leguminous crop such as peas, clover, alfalfa, etc., to take some soil from a field where this crop has been growing, and sprinkle it

A PROVED PRODUCT For VICTORY GARDENS

Insures successful crops! Ideal for vegetables, flowers and shrubs as well.

The Soil Insulator and Protective Mulch That

- Cuts Down Watering
- Saves Cultivation
- Reduces Weeding
- Improves Root Development

On Sale at All Good Garden Stores

SOLE MANUFACTURERS

Redwood Fibre Products Co., Inc.

Dept. O. — Santa Cruz, Calif.

on the new field. The old soil is full of the necessary bacteria and in this manner will help the new crop to act properly. Regarding the fact that only certain bacteria will act with certain leguminous plants, this is true.

Sir E. J. Russell, in his book "Soil Conditions and Plant Growth" has the following to say, regarding such bacteria:

"Some 15 to 20 varieties are so far known, each of which can infect only a limited number of species. This specificity is of great agricultural importance, and explains the necessity for supplying the appropriate bacteria where certain leguminous crops are being introduced into a new district. Various of the organisms can cause the root hairs to curl, but only the specific organisms can enter."

Where the soil becomes naturally enriched with ordinary bacteria due to many years application of composts to the soil, such inoculation isn't as important as it would otherwise be. That this is so is stated by Dr. Firman E. Bear in "Soils and Fertilizers" as follows, "even under field conditions, nitrogen fixation by non-symbiotic bacteria may take place at a very rapid rate over short periods of time if conditions are favorable."

What would happen if many of these strains of bacteria would be mixed together? Would they eat each other up? No, they would not. But, as Dr. Russel has in effect stated, the wrong bacteria would not gain entrance, because they don't know the pass-word. These bacteria which do not have the proper host, so to speak, are able to get nitrogen from the air, without the help of, and outside the roots. They will continue to exist so long as conditions are favorable. An acid condition tends to make them disappear.

SANI-SOIL

I wonder if you can tell me if Sani-Soil would be a good annual summer mulch for perennial beds in the middle west? If so, should this material be removed in autumn? It has been our experience that flower beds can become too porous, so that soil dries too quickly in our hot, dry summers. We need some clay in such beds. The thought occurred to me that if one applied 1½" of Sani-Soil every summer, and dug it in lightly, the beds would eventually become *too* light.

I have been greatly interested in your theories of gardening, in "An Agricultural Testament," and in the Debates in the House of Lords which you report.

Ruth S. Alter,
Cincinnati, Ohio.

EDITOR'S NOTE:—We referred this letter to the Redwood Fibre Products Company, manufacturers of Sani-Soil and they replied as follows:

Dear Mrs. Alter:

Your letter of March 29 re Sani-Soil addressed to Organic Gardening was sent to us for an answer.

Where Sani-Soil is used as a surface mulch in order to protect the soil from baking and caking and to retain moisture, it can be raked off in the fall and kept over for the next season to be used over again. For instance here in California the Vetterle & Reinelt Begonia Gardens cover most of their fields with a two inch layer of Sani-Soil and when in the fall of the year their bulbs and plants are taken out of the ground for storage the Sani-Soil is raked up to one end of the field and left there until next spring, then it is spread over the same area again. This way Sani-Soil will furnish coverage for several years to come and its cost

THE SCHOOL OF LIVING
SUFFERN, N. Y.
Summer School—1944
Announces 15 day Session
Homesteader's Course—July 7-22
For those wishing information about acquiring and using land, developing co-operative homesteading communities, and practicing cooperative production and exchange.
WRITE FOR CIRCULAR
SCHOOL OF LIVING,
Suffern, N. Y.

SEND FOR FREE CIRCULARS
We have printed some leaflets describing what ORGANIC GARDENING MAGAZINE stands for. Possibly you might want to help along this movement by sending some to friends. Let us know how many you need.
ORGANIC GARDENING,
Emmaus, Pa.

The School For Living
Suffern, N. Y.
Welcomes requests for information on how to live contentedly and be self-contained on a small place in the country.

SUBSCRIBE TO
ORGANIC GARDENING
Devoted exclusively to demonstrate that organic gardening is the only practical way to garden. Each month there will be presented many unusual articles, hints, short-cuts, new discoveries, etc. This magazine will be worth many times its subscription price to you. Issued 12 times a year.

ORGANIC GARDENING
Emmaus. Pa.
Gentlemen:
Enclosed is $3.00 for one year subscription (12 issues) to Organic Gardening.
NAME .....
.....
ADDRESS .....
.....

of application is considerably reduced when spread over two to three and as high as four year periods.

We would like to draw your attention to the fact that Sani-Soil differs from peat-moss in this respect, that it does not absorb moisture itself. It acts rather like spun glass which has no capillary attraction. Peat-moss incorporated in your soil structure will soak up moisture from the soil and even away from your plant roots like a sponge. The value of Sani-Soil consists when incorporated in your soil structure in the fact that it will keep your soil particles separated preventing packing of the soil, and in this respect increases the water holding capacity of any type of soil without using any of the moisture itself. When Sani-Soil is incorporated in the soil structure at the rate of one and one-half inches this will be only required once in perhaps ten years. It will retain its ability to keep the soil loose and friable for perhaps a longer period than that. Its rate of decomposition is very slow and up to the present time has not been determined yet. We do not believe that there exists any danger where Sani-Soil is used as recommended that the soil will become too porous.

Yours truly,
Redwood Fibre Products Co., Inc.

John Alexander,
General Manager.

EARTHWORM PITS

I have a 90 acre hillside farm in Jefferson County, Ohio, upon which is a fine medicinal mineral water spring. This farm has been neglected for the past 15 years, with 24 acres of run-down and neglected apple orchard and a growth of broom sage on parts of the hills.

I am planning upon planting about 200 young fruit trees, peach, apple etc. this next month, and intend to use the earthworm plan from there on.

We have an old cistern which is not being used and I wish to make an earthworm pit of it. Will you please advise me how to procede with it? The cistern is a large one and now has stale water in it—can I fill it up to within about 6 feet of the top and then prepare it for a worm pit and what should I place in it to make it right? We have some poultry and a horse with sizable amount of both manures.

Mrs. Scott Krauss,
Columbus, O.

EDITOR'S NOTE:—This letter was submitted to the Ohio Earthworm Farms, who replied as follows:

Dear Mrs. Krauss:

You are very fortunate to have a hillside farm with a sizable amount of animal manure and the idea of EARTHWORMS to rebuild that farm. The old cistern which you are considering using as a pit for your Earthworms may be an asset, so let us look at it from many angles.

First the stale water will have to be drained out of it and the cistern will have to be so constructed that it will have drainage at all times. The Earthworms like nice moist dirt, but not a soggy or stagnent condition. So it looks like you will have to dynamite the bottom, then fill it up to within about six feet of the top with discarded bolders and trash of any sort and then fill in with grass cuttings, weeds, discarded fodder, even spoiled hay in fact anything that can not be used by any other animal and make at least the last two feet a mixture of ½ animal manure and ½ dirt. If you are fortunate to be near one of the peat mines of Ohio use 1-3 manure, 1-3 dirt and 1-3 peat. The peat has very little food value but the water holding capacity is very advantageous to an Earthworm pit. It also adds much to the lightness of the compost after the Earthworms have done their work.

So much for the construction, now we should consider after the stagnant water is drained off, there will naturally drain thru your Earthworm bed the excellent liquid fertilizer which should be used so we should make arrangements to use that and if the hillside has a spring lets put in a tile and tap that water. This will depend on the contour. Now will all this cistern construction be easily accessible to your com-

(Continued on inside back cover)

DOMESTICATED EARTHWORMS

Compost all animal manures and organic waste with earthworms, to rapidly produce highly fertile topsoil. My complete production manual—. **"EARTHWORMS: Their Intensive Propagation and Use in Biological Soil Building."** —prepaid for $1.00, with 30 days return privilege. Valuable information mailed free on request.

Thos. J. Barrett,
Earthmaster Farms, Box C-10, Roscoe, Calif.

"SOILUTION EARTHWORMS"
THE AUTOMATIC GARDENER
Soil Rejuvenators
Nature's Plow
Nature's Chemist
Nature's Humus Makers
Conservors of Waste
Put Nature to Work While You Labor or Rest
EARTHWORMS Raised and Seasoned to Hard Winters and Summers.
OHIO EARTHWORM FARMS
THE WARNER'S
WORTHINGTON, OHIO.

De La Mare Garden Books

GARDENING IN THE SOUTH. By George R. Briggs
232 pages. 91 illus. $2.00
The first book devoted specifically to the beautifying of home grounds in the Upper and Middle South.

FLOWERS OF THE WILD. By Frank C. Pellett
170 pages. 100 Illus. Four 4-color plates. $1.00
Reveals the possibilities of developing attractive floral displays in the garden through the sole use of woodland natives.

ADVENTURES IN DISH GARDENING
By Patten Beard
218 pages. 68 Illus. Four 4-color plates. $2.50
Dish gardening is an old Japanese art, a Western interpretation of which has been evolved by Miss Beard. Nature's own materials of stones, clay and growing things are used to fashion the various types of dish gardens.

CITY AND SUBURBAN GARDENING
By Chesla C. Sherlock
196 pages. 77 illus. $1.00
A book for those who wish to make the most of moderate space. Years of experience in city and suburban gardening and contacts with thousands of home owners enable the author to write with authority.

ORNAMENTAL DWARF FRUIT TREES
By Eberhard Abjornson
66 pages. 25 sketches. $1.00
Dwarf fruit trees are highly valuable in small gardens. They may be trained to cover bare spaces such as walls, sides of buildings, etc. The author of this book is a skilled grower and tells the home gardener how to raise all kinds of ornamental trees that will bear within a few years.

A LITTLE BOOK ON CLIMBING PLANTS
By Alfred C. Hottes
250 pages. 80 illus. $2.00
The only single book obtainable which deals solely with vines. The list discussed is surprisingly large and will be especially welcome to those who want something different or unusual to screen an unsightly spot or to furnish shade and beauty.

BIRDS OF THE WILD. By Frank C. Pellett
128 pages. 74 illus. $1.00
Of absorbing interest to the bird lover who wishes to attract the feathered friends to his home garden.

1001 GARDEN QUESTIONS ANSWERED
By Alfred C. Hottes
388 pages. 160 illus. $2.50
An amazing collection of useful information for the amateur gardener wishing to plan and manage his own home grounds. Answers to all kinds of garden questions, from what to plant on the north side of the house to what time to put Waterlilies in the pool, will be found in this new and vastly improved edition.

THE BOOK OF TREES. By Alfred C. Hottes
448 pages. 200 illus. $3.50
An all-around handbook for the tree lover and tree planter. There are chapters on trees important in American history on favorite tree poems, on street trees, on roadside trees, on nut trees, etc. Transplanting, pruning and propagation are covered and a variety of helpful lists for various purposes are given.

PLANT PROPAGATION. By Alfred C. Hottes.
238 pages. 136 illus. $2.00
All amateurs have an intense desire to multiply desirable plants. In this book the whole subject is covered, whether seeds, buds, bulbs, grafts or cuttings are discussed.

HOW TO LANDSCAPE YOUR GROUNDS
By Loyal R. Johnson First Edition
232 pages. 147 illus. $2.75
For the benefit of the hundreds of thousands of home builders and owners in the medium income bracket who are anxious to beautify their home surroundings to the best advantage at small expense. Not to be found in any other landscape book are its planting plans covering practically every section of the country—from Massachusetts to Florida and Louisiana, and from the Middle West to California—together with its extensive Select Lists of Shrubs, Trees and Vines. A complete guide to the planning, construction and planting of the garden and grounds.

PRACTICAL LAWN CARE. By Mortimer C. Merritt
32 pages. Illus. 75c.
Gives all the essential information for making a new lawn or the renovation of an old one, plus ways and means for keeping lawns in good condition.

COMMON SENSE IN THE ROCK GARDEN
By James H. Bissland
218 pages. 62 illus. $2.50
Written by a practical man for practical people. It stresses simplicity in design and construction and shows how to select and arrange plant material for the most telling effect; how to build and plant for permanency.

BOOK OF PERENNIALS. By Alfred C. Hottes
280 pages. 103 illus. $2.00
Among amateur gardeners there is a decided preference for perennial plants, largely because they require but little care and so generously reward even that little. For those desiring a continuous show of color from early Spring to early frost in their gardens, this book will be extremely valuable, discussing over 125 separate species individually, with their culture and requirements.

BOOK OF SHRUBS. By Alfred C. Hottes
448 pages. 190 illus. $3.00
Appeals to every home owner, plantsman, student and landscape architect, and is a mine of information on everything relating to these woody perennials as grown in all sections of the country. Numerous lists of different shrubs for different purposes and full details of care and culture are given.

BOOK OF ANNUALS. By Alfred C. Hottes
180 pages. 158 illus. $1.50
The author opens up many new possibilities to garden makers in this book, which is exceedingly complete, and all in all is a most useful manual dealing with annual flowers. With annuals alone almost every kind of effect can be secured, while the combinations of flowers which are made possible by a little study are most alluring. Over 100 separate species of annuals are described, with full directions for their culture and uses.

PRINCIPLES OF FLOWER ARRANGEMENT
By Prof. Edward A. White
202 pages. 67 illus. Four 4-color plates. $3.00
In a class by itself—the one scholarly work on the subject, which accurately considers every problem of color, line, design or style. Illustrated with excellent halftones of prize winning compositions by garden club exhibitors and from photographs of arrangements made by some of the best flower artists in America.

WATER GARDENS AND GOLDFISH
By Robert V. Sawyer and Edwin H. Perkins
272 pages. 126 illus. $2.00
A fund of information on these two closely connected subjects such as has never before been presented in one volume, the range of appeal extending from the keeping of a few fish in an aquarium and the growing of a Waterlily or two in a pan on the porch all the way to professional goldfish breeding and the commercial water garden.

While these books are not written from our "organic point of view" they should be in every gardener's library.

Organic Gardening — Emmaus, Pennsylvania

(Continued from page 31)

post? A pit should be divided into sections so that you will not disturb the other side working, while using one side. The best is to have a pit in fourths and use one fourth letting the rest work and when you have completed this one you can start it over. Remember the Earthworms are Nature's medium of breaking down and returning back everything to the soil in the shortest possible time, so use any composting methods that suits your taste but add Mr. Earth Worm.

This might be a very expensive project and a lot of manpower which is so scarce today. The idea back to the EARTHWORM is "THERE IS NO WASTE"? USE WHAT YOU HAVE. "A LABOR SAVOR." "LET THE EARTHWORMS DO YOUR WORK." "THEY ARE YOUR CHEMIST, YOUR FERTILIZER" and etc. You have made use of the old cistern at great cost and I fear the labor to get the finished product will prove a liability instead of the asset of which you contemplated.

Also SOILUTION Earthworms are fellows that like to work deep and if they should fall thru into the bolders and stuff you filled up your cistern with they would be lost. We have a cistern here at our place and considered using it, but after thinking all these things thru we decided that the rain water it would catch and hold was of far more value than the pit could possibly be. You know rain water is so very much better than the chemically treated city waters for plants.

I would suggest that you make a compost pile in the handiest place, in the shade of a tree (not too close) and some place that would not be back-breaking in turning and etc. We have numbers of them piling their leaves, grass cuttings, hay and weeds right on the top of the ground and hollowing it in the center so that water will run into it instead off the sides and adding the Earthworms. Add a couple of boards on top as they love a weight. You have noticed them under a stone. Start another pile and soon you will have plenty of Earthworms to impregnate your place.

Some one made the remark after visiting us that we put every thing to work, wasted nothing, and that it was so very simple that folks tried to make a hard job of Earthworm farming. If all the Earthworms in an acre of good ground was weighed you would find that you have more animal weight per acre under the ground than you could possibly maintain off an acre on top working for you.

Hope the above information helps you, and we will be very glad to answer any other questions on Earthworm Farming.

Very truly yours,
Ohio Earthworm Farms,
Bernice Warner.

HEALTH AND FOOD . . . .

(Continued from page 17)

remedy, laxative, cough syrup, etc. for which they had reached. Insecticides, especially sodium fluoride, used by error in place of baking powder, cause a number of the deaths.

Wood alcohol and denatured alcohol, the statisticians find, are still used by some reckless persons as a substitute for grain alcohol, and take a toll of about 150 lives a year.

Some deaths that have occurred are traceable to wartime conditions, as in the misuse of insecticide powder mistaken for sugar because sold in paper bags, on account of the shortage of tin cans; spraying compounds kept in the home for use in victory gardens; and poisonous substances taken by mistake from the medicine shelf during a blackout. Despite such incidents, the statisticians declare, there has been no increase in accidental poisoning since the United States entered the war, and the death rate from poisoning has been declining in the United States over a long period of years, "with the result that the present rate is only about half what it was during the first World War."

PLOWMAN'S FOLLY

BY EDWARD H. FAULKNER

This is the book you have been hearing so much about.

CLOTHBOUND EDITION

NOW ONLY $1.00 POSTPAID

WHILE we do not quite agree with Mr. Faulkner's main theme we believe this to be a valuable book which should be read by everyone interested in organic farming and gardening. There is much interesting material in the book showing how to increase the humus content of soils.

There are some situations in which plowing is not desirable, and your ability to decide on such cases will be helped by reading the book.

ORGANIC GARDENING
Emmaus, Penna.

AN AGRICULTURAL TESTAMENT

By Sir Albert Howard, C. I. E., M. A.

Formerly Director Institute of Plant Industry Indore, and Agricultural Adviser to Central India and Rajputana.

Sir Albert Howard C. I. E., M. A.

CONTENTS

1 Introduction

Part I

The Part Played By Soil Fertility In Agriculture

2 The Nature of Soil Fertility
3 The Restoration of Fertility

Part II

The Indore Process

4 The Indore Process
5 Practical Application of the Indore Process
6 Developments of the Indore Process (A)
7 Developments of the Indore Process (B)
8 Developments of the Indore Process (C)

Part III

Health, Indisposition, and Disease in Agriculture

9 Soil Aeration
10 Some Diseases of the Soil
11 The Retreat of the Crop and the Animal Before the Parasite.
12 Soil Fertility and National Health

Part IV

Agricultural Research

13 A Criticism of Present-day Agricultural Research
14 A Successful Example of Agricultural Research

Part V

Conclusions and Suggestions

15 A Final Survey

Appendixes

This is the recognized standard text book for gardeners and farmers who wish to change from the use of ordinary chemical fertilizers to home-made organic fertilizers. Sir Albert Howard has forty years of active experience in the field of organic fertilizers and is the accepted leading authority on the subject.

We have arranged to print this book in the United States and have been able to reduce the price to ....

$3.50

Postpaid

Canada and Foreign—35c extra

Organic Gardening

Emmaus, Pa.